Learners' learning through digitised learning resources in Mauritian Primary Schools

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DEDICATION

I place a special dedication to my sweet little angel, Hibah Sophia, who inspired me a lot during the writing of this thesis.

DECLARATION

I, WAAIZA UDHIN, declare that the thesis

LEARNERS' LEARNING THROUGH DIGITISED LEARNING RESOURCES IN MAURITIAN PRIMARY SCHOOLS

submitted to the University of Kwazulu-Natal, South Africa, for the degree of Philosophy of Education has not been previously submitted by me for degree purposes at any other University. I further declare that this dissertation is my own work in design and execution, and that all the sources that I have used or quoted therein have been duly acknowledged by means of complete references.

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Waaiza Udhin

November 2019

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Theses just don't appear. Aspirations, desires and commitment are forces that contribute to creating a thesis. This Doctoral Thesis resulted from various intersecting forces. First force was the desire to research "learning" in our primary schools using the latest technology, as this form of learning is relatively new in Mauritius. The second force was the desire to offer a guide for educators to know more about their learners and hence guide them into their passion and love for teaching. The third and last desire was to enhance the body of knowledge in the field of learning with technology.

First, I thank God, the Almighty, for helping me to complete this thesis besides the numerous challenges that I went through my journey.

I also place on record the love, patience and support of my husband Shakeel and daughter Hibah during the hectic journey. I am indebted to my family for their special attention and care when I was ill and hospitalised.

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ABSTRACT

With the fourth Industrial Revolution on our doorstep, Information and Communication Technologies (ICTs) continue to have a major impact on our everyday living, and more so in education. There have been many initiatives to integrate the use of ICTs in teaching and learning, worldwide. The Mauritian National Curriculum Framework, Grade 1-6 (NCF, 2016) advocates an emphasis on the integration of ICT in Mauritian Primary Schools. In the context of this initiative, Mauritius has embarked on the digitisation of the print-based curriculum. In classrooms, the interactive digitised learning resources are displayed on 'Interactive Whiteboards' (IWBs) to support teaching and learning. Hence, this resulted in the reconceptualisation of the teaching and learning processes within the classrooms. Moreover, since the use of technologies in primary classrooms is relatively new, minimal research has been done to analyse learning through digitised resources in Mauritius. This study contributed to addressing this gap by providing a critical examination of learners' learning through digitised learning resources in Mauritian primary schools. Moreover, analysing learners' learning through digitised resources was an important step that would eventually inform policy. The goal of this study has been to explore learning through technology in the metamodern era. The framework used for this study was 'metamodernism'.

The route to gain insights into learners' learning deploys an analysis of the participants' interactions through the digitised learning resources in Grade 4 primary classrooms. The interpretative paradigm determined the choice of case study as a research methodology. Purposive sampling was used to select eight- to nine-year-old learners from two different schools. The sample size was seven learners from both schools. Collection of data was made possible through semi-structured interviews, observations and children's creative drawings. An assemblage of the data collected from the different sources was carried out. To better foreground the richness and authenticity of the children's learning, the findings were presented through short stories. The short stories were woven into

texts that depicted the learning patterns and the influential factors that informed learning through digitised resources.

The findings were analysed through the inductive approach. They revealed that ‘all learning is narrative’ and that learning happens within context. They also indicated that habits or culture, learners’ experiences and personality of learners largely determine the ways the learners learn through digitised resources. Moreover, blurred boundaries wherein a multiplicity of intersecting factors provided explanations of the ways learners learn through digitised resources. In the same vein, a ‘narrative model of learning’ was presented.

The thesis concludes by elaborating on the theoretical, methodological, conceptual and scholarly contributions of the study. The main scholarly contribution is that enabling conditions combine to bring the learner’s learning to a higher level of cognition, which refers to virtual reality.

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LIST OF ABBREVIATIONS

AACE	Association for the Advancement of Computing in Education
CISCO	Computer Information System Company
CMCP	Computer Mediated Communications and Pedagogies
CODL	Centre for Open and Distance Learning
CPE	Certificate of Primary Education
DLR	Digitised Learning Resources
GOVT	Government
HBDI	Hermann Brain Dominance Instrument
ICT	Information and Communication Technologies
IP	Interactive Projector
IRCS	Internalise, Replicate, Customise, Self-evaluate
IWB	Interactive Whiteboard
MIE	Mauritius Institute of Education
MITD	Mauritius Institute of Training and Development
MoE	Ministry of Education
NCF	National Curriculum Framework
NYCBE	Nine Year Continuous Basic Education
ODL	Open and Distance Learning
UoM	University of Mauritius
VAK	“Visual”, “Auditory,” and “Kinaesthetic”
VLE	Virtual Learning Environment
WBTM	Whole Brain Thinking Model
ZPD	Zone of Proximal Development

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Part 1: Setting the scene

Chapter 1: - Introducing the study

1.1 Introduction

This doctoral study, located in the digital age, focuses on learners' learning with digitised learning resources. As far back as 1990, Papert argued that loyalty to conventional and fixed teaching and learning methods could contribute to one of the greatest hindrances to educational reform. The reason for using Papert's view is to illustrate the complexity in the thinking about the use of technology in education, since the modern era (c. 1500 to c. 1800). In the 1960s, people ridiculed Papert as he talked about children using computers as instruments for learning and promoting creativity and innovation (Rifkin, 2016). The idea of one personal computer for every child just like a notebook and a pencil was science fiction at that time. However, Papert had the vision that the computer, if properly used as an educational tool, could provide the basis for a 'megachange' in education, in that teachers could be enabled to rethink what learning is all about and to possibly rethink education (Papert, 1990). Papert believed that personal computers were the ideal medium to engage students with powerful representations and argued that children can communicate naturally with computers in the same way as they learn to speak a foreign language (Papert, 1990). Papert coined the term 'technocentrism', which referred to the tendency to give a similar centrality to a technical object – for example, computers. This tendency showed up in questions like: 'What is the effect of the computer on cognitive development?' (Papert, 1980, p. 1).

However, Papert's vision has been critiqued by postmodern thinkers who have expressed doubt about the use of technology for learning. Moreover, there are contrasting views regarding the worth of digital technologies in relation to learning and education in general. On the one hand, technology is considered to support the pedagogy leading to democratising the classroom and engaging students (Himmelsbach, 2019). On the other hand, technology can also be distracting for

learners (Himmelsbach, 2019). This oscillation with paradoxically opposing views on the use of technology in education may be an indication that we have gone beyond postmodern thinking. We are now possibly in an era which is post-postmodernism; also known as metamodernism. 'Metamodernism is regarded as the dominant cultural philosophy of the Internet age' (Abramson, 2015, p. 1). Like post-postmodernism, it could also indicate a temporal marker, an era beyond postmodernism. However, more than this, metamodernism has been used as a theoretical lens and philosophy from which the researcher has examined the phenomenon of learning in this doctoral study. A detailed explanation of metamodernism will be presented in Chapter 3 of this thesis.

The introductory chapter sets the scene of the study by providing a description of the problem statement followed by the research questions that are placed under the lens to better understand learners' learning through digitised learning resources. It then portrays the background and context of the study. The next section details the rationale of the study where arguments are put forward for the need to analyse learners' learning within a digital classroom. A presentation of the key terms and concepts foregrounded in this research (digitised learning resources, learners' learning and the digitised classroom) gives the reader a broader picture of the terms used in the research. These concepts are dealt with in detail in the subsequent chapters, especially in Chapter 2, the literature review. A brief account of the theoretical framework as well as the research design and methodology are presented in the introductory chapter. These will be discussed in detail in Chapters 3 and 4. The intention behind explaining these details is to help the reader understand the journey in this doctoral study.

1.2 Problem statement

One of the largest sub-sectors of education systems around the world is primary education, which is responsible for educating young learners, thereby contributing to the transformation of societies (UNESCO, 2012). The young learner will need to be equipped with a set of skills to be able to address the challenges of the rapidly evolving environment where the only constant is change. The traditional approach where the teacher only transfers knowledge to

learners is fairly static and does not prepare a learner for change (Ukpokodu, 2009). Instead, it prepares learners for passively accepting change without asking too many questions. However, 'transformative pedagogy' enables learners to be actively engaged in the learning process.

> Transformative pedagogy is defined as an activist pedagogy combining the elements of constructivist and critical pedagogy. It empowers students to critically examine their beliefs, values, and knowledge with the goal of developing a reflective knowledge base, an appreciation for multiple perspectives, and a sense of critical consciousness and agency (Ukpokodu, 2009, p. 43).

This pedagogy was based on ideas from Paulo Freire, such as dialogic education rather than 'banking education' (Senteni, 2007, p. 1). The 'banking model of education' is a term used by Paulo Freire to describe and review the traditional education system. The term uses the metaphor of students as containers into which educators must transfer knowledge.

A relevant education is not limited to a classroom but seeks to contextualise the issues by the surrounding areas and people as parts of the learning environment (Senteni, 2007, p. 1). Therefore, the learners being part of the environment have grown up using interactive smart phones, tablets and touchscreen laptops and many of them may have different learning styles from the previous generation. Hence, with the advent of new and evolving technologies, teaching and learning need to be reconceptualised while at the same time serving as a key indicator for transformation and innovation. However, researching teaching and learning with Information and Communication Technology (ICT) in primary education is a great challenge and a gap in the Mauritian education system. The use of ICT is emphasised in Mauritian primary schools, but minimal research has been done to explain how learners are learning with the integration of digitised learning resources in classes. This study contributes to address this gap by bringing new knowledge and dimensions about learning through the digitised learning resources in Mauritian primary schools.

The different stances discussed above resonate with policies outlined and implemented at national level in the Mauritian context. One of the pillars of the

ongoing education reforms in Mauritius (the Nine Year Continuous Basic Education, or NYCBE) is innovative pedagogies (NYCBE, 2016). In the NYCBE document, innovative pedagogies are operationalised through terms such as technology, e-learning resources and IT-mediated learning. Adding to the above, another pillar of the reforms focuses on the transformation of the learning environment with technology and thus the NYCBE document anticipates the redefinition of classroom boundaries. However, the document does not state anything about classroom dynamics. In all fairness, it would have been difficult for authors to delve into classroom dynamics, especially learners' learning with technology, as they need to be researched in actual classroom situations. This is where the study provides some insights.

Furthermore, one of the key documents outlining the Mauritian educational policies and strategies for the primary phase, the National Curriculum Framework (NCF, 2016), lays much emphasis on the use of ICT in teaching and learning. Indeed, one of the main features of the NCF for the primary school sector is about embedding ICT in the teaching and learning process. The aim is to encourage teachers and learners to make pedagogical gains using technology. Technology in this context refers to digitised learning resources and e-materials. However, the researcher believes it is essential for policy makers, the Mauritius Institute of Education (MIE), and the education sector in general to understand how learners learn with these resources. The pedagogical viewpoint, more specifically learners' learning with technology, has to emerge so that it informs policy.

From a pedagogical stance, a Mauritian pedagogue, Dr Atchia, stated that the Mauritian education system is not actually preparing our children to embark on and function in the world of the future (Atchia, 2017, p. 9). It was argued that there is a dissonance between the programmes/syllabuses offered in the Mauritian primary schools and the needs of the 21st-century learners. It is debatable whether learners are being prepared to meet the demands of the 2030s (Atchia, 2017). To be able to set the foundation for the development of our human capital towards higher sustainable economies, it is thus of prime importance to set the direction for learning, bearing in mind the needs of the 21st century learner. Oosthuizen (2008) also argued that if the gap between how

students live and how students learn is not filled, the contemporary education system could become obsolete (Kang et al., 2016). In the 21st century learners have the ability to take integrated information to a new level and they require very quick access to the new knowledge. The internet has shrunk the world into a global village where people have easy access to information in just one click. The phenomenon of learning in this new century entails designing the right curriculum that matches the future needs of learners.

In the same vein, the educational reform in Mauritius is designed on the premise that 21st-century learners should be well versed in technological advances, as they will enter a global workplace that will require technological competencies. One of the goals of the new NCF Grade 1-6 (2016) is that education should 'develop in learners appropriate knowledge, understanding, attitudes and values to prepare them for life and further education' (NCF 2016, p. 4). So, the study made a major contribution to the attainment of this goal as understanding how learners learn in this new world will bring a new dimension to the pedagogies adopted in the classroom, leading to a more responsible and effective use of technology in the classroom. The NCF (2016) also emphasises the fact that the primary education should support the development of the 21st-century competencies and life skills for learners to be able to function in the knowledge-based economy, adapt to the rapid change, and compete at a global level. However, the digitised curriculum is relatively new in Mauritian primary schools and no research has yet been done on how learners actually learn through this digital curriculum.

1.3 The focus of the study

This study was motivated by the researcher's keen interest in understanding children's learning and a belief that the quality of learning could be enhanced by expanding the dynamics of the interactions within the digital classroom. Prensky (2001) coined the terms 'digital natives' and 'digital immigrants', and it was believed that students today think and process information in different ways and their learning preferences tend more towards collaboration and teamwork, flexible learning environment and getting student voices heard in the learning

process, as opposed to traditional lecture-type approaches (p.1-2). This view was shared by other authors like Gibbons(2007); Rainie, (2006) and Underwood (2007), who argued that the difference in the way people from different generations process information has eventually extreme implications for education (Helsper & Eynon, 2010). Indeed, the supporters of this view saw a "digital disconnect" between the learner and the teacher in the class (Underwood, 2007) which may create problems in the interactions between the teacher and learners.

In this thesis, a perspective and observational method has been developed to analyse learning as it unfolded among learners of Grade 4 in the digital classroom in Mauritian primary schools. The emphasis was on the active role played by learners in both the digital classroom and their involvement in the essential aspects of learning in the metamodern era. The vehicle for developing this understanding was a case study of learners' learning in Grade 4 with the aid of digitised learning resources.

Indeed, the successful integration of technology, more precisely the interactive projector, in Mauritian primary schools is contingent upon and indeed useless without a clear understanding of the mechanism of learning within the technology-enhanced classroom. So, the primary aim for this study was to throw light on the dynamics involved in the learning process among the Grade 4 learners in their class, by exploring the role of the digitised learning resources as a stimulus.

The aim of the study was to carry out an in-depth analysis of the ways in which learners experience, conceptualise and learn the various concepts via a digital medium. However, providing an explanation of the ways in which learners learn through the digital resources is not the same as providing an explanation on conceptual learning of science through ICT. Therefore, the intention was to gain an understanding of learners' learning as emerging from the interactions that take place within the digital classroom, being among the learners, through the digitised learning resources or any other stimuli that may influence the learning process. Furthermore, the study sought to present an insight into the different learning

structures and role played by technology in shaping the trajectory of the learning process in a metamodern era.

Eventually, the study provides a substantial contribution to developing a different view about issues in a digital classroom, which are often ignored in studies on learning. The outcomes provide ways of extending our knowledge of how learning through digital resources can facilitate the curriculum design and implementation process, and an analytical approach that can inform the dominant cultural philosophy in the internet age, being metamodernism.

In the face of increased use of technology in education, it is not only the resources that are changing, but the whole classroom has transformed. The digital classroom offers a different context for interactions to occur. The new learners have a completely different view of what a classroom is compared to learners of the 20th century. Therefore, there is a great need to understand the dynamics of the interactions and the formation of collective commitment in the complex technology-enhanced learning environments. Consequently, the study concentrated on the exploration of ways in which learners mediated the interactions to learn the concepts taught in the lesson through the use of digitised learning resources.

The main aim of this study was to develop an in-depth understanding of the learning that happens among Grade 4 learners through the use of digitised learning resources. The specific objectives of the study were:

1. To document the learning process and observe the different tools, techniques and strategies involved to provide insights into the process;
2. To examine how the digitised learning resources impact on the interactions among the different actors (teacher and learner) within the digital classroom; and
3. To provide a conceptual understanding of learning assemblages within a digital classroom.

‘Learning assemblages are formed from the combinations of elements and other things in relation through relatively random encounters where they then

function together' (Hargraves, 2014, p. 1). 'An assemblage describes a process rather than a fixed combination and has self-organisation and self-emergence'. (Hargraves, 2014. p. 1).

The specific research questions for this study were:

1. What do learners learn through the digitised learning resources in Mauritian primary schools?
2. How do learners learn through the digitised learning resources in Mauritian primary schools?
3. Why do learners learn the way they do when using the digitised learning resources in Mauritian primary schools?

To provide answers to these questions, metamodernism was chosen as a framework, as it allowed the researcher to explain the complexity of learning within a technology-enhanced classroom. The metamodernism philosophy was used as a lens to analyse learning because one could view the dynamics of learning manifested in the metamodern era and its associated beliefs concerning the use of technology in education. As the learning assemblages were mapped through use of digitised learning resources, the researcher developed an in-depth understanding of the dynamics involved in learning and the role played by the digitised learning resources during the learning process. Metamodernism offers a rich temporal marker that was used to develop an analytical lens to examine and illuminate how learning unfolds with the introduction of IWBs in Mauritian primary schools.

Metamodernism is a 'structure of feelings' about social phenomena (Vermeulen & Van den Akker, 2015, p. 1). This is taken to mean that metamodernism reflects a type of social experience different from social experiences in other eras. Accordingly, the methodological rationale developed for this study concerns tracing the complexity in learning in the digital age and among children whose interactions are often unplanned and innocent. The researcher followed Prensky's (2001) and Giroux's (2004) guidelines of studying learners learning in the digital age, focusing on how learning emerged among the Grade 4 learners. In addition, the researcher explored how learning in the metamodern era could

be a breakaway from learning in the postmodern era and the oscillation between the traditional methods of learning and new forms of techniques and tools used in a digital classroom. Accordingly, to capture and trace the various forms of learning and the competencies of the learners in the digital classroom, it was necessary to broaden the notion of learning to include more than simply learners as embodied persons. That is to say, learning could also be analytically traced in the strategies that were assembled for the teaching of specific lessons in Grade 4 in the discursive deployment of the artefacts within the digitised learning resources that inform and support teaching and learning.

1.4 The background and context of the study

1.4.1 The country profile

This study was conducted in Mauritius, a small island of 1,860 square kilometres located in the southern part of the Indian Ocean. Figure 1.1 indicates the location of the island of Mauritius in the Indian Ocean.

Figure 1.1 Map of Mauritius in the Indian Ocean

Source: ontheworldmap.com

Mauritius has witnessed several waves of colonisation. Arabs and Portuguese visited the island hundreds of years ago (Selvon, 2005). The first human inhabitants of the island were the Dutch who settled on the island in 1638 and

left in 1710. Toussaint (as cited in Selvon, 2005) stated that the French took possession of the island and named it Ile de France. The French colonisation lasted for a century before the British displaced them in 1810. The British granted independence to Mauritius in 1968 (World data on education, 2006/7) and Mauritius became a republic in 1992.

After independence, the economy depended heavily on agriculture. Manufacturing, and the textile and apparel industry began to take a larger share of the economy in the 1970s and 1980s. The next decade saw the blooming of the services sector, namely financial services and tourism sectors. With the advent of the new millennium, the Mauritian economy took yet another turn; investments were made to turn Mauritius into a cyber island. The country started to provide ICT-related services such as outsourcing business and knowledge processes. Economic diversification could be a characteristic of the Mauritian economy; indeed as to date economic actors are engaging in yet another field; the ocean economy. Moreover, these economic transitions described above have deep implications for the Mauritian education system.

1.4.2 The education system in Mauritius

Since Mauritius was a British colony, the Mauritian education system is based on the British model and has always remained high on the government's agenda. English is the medium of instruction in Mauritian schools. It is also the language of administration and the legal regimen in Mauritius, although the majority of the population speaks Mauritian Creole, which is French-based, in casual interactions.

Moreover, the challenges of economic survival and diversification can only be met through a reliant and robust education system that can deliver competent and efficient human capital. This has resulted in a huge investment in the education sector, both human and material, to an impressive progress allowing free education up to the age of 16 in the country.

The education sector is administered by the Ministry of Education and Human Resources, Tertiary Education and Scientific Research. It has under its

responsibility the various educational sectors such as the primary, secondary, technical and tertiary sectors. The Ministry of Education of the country has a mission to 'create an enabling environment for a higher education system that both generates and equips learners with innovative, cutting-edge knowledge and deep skills for increased competence in a dynamic work environment' (Ministry of Education and Human Resources, Tertiary, 2017). The state also plans to foster innovation for developing and sustaining an education system that will meet the challenges and demands of the future world (GIS, 2018). Indeed, the primary education system in Mauritus has the largest uptake of technology which actually helps in addressing the challenges of the 21st century. The primary schools in Mauritius accommodate learners ranging from 5 to 10-11 years old. The classes are labelled as Grade 1 for youngest students and Grade 6 for elder students. This study was conducted with Grade 4 learners of age group 8-9 years old all Grade 4 were equipped with Interactive Whiteboards.

1.4.2.1 Role of ICT in education

Today, 'ICT plays a major role in the education sector, precisely in the process of empowering teachers to use technology in educational activities' (Kaka, 2008, p. 1). Moreover, over the last decades, professionals in education and governments all over the world have recognised that ICT has many exceptional facets or promises that help to promote teaching and learning in primary schools. Indeed, the success of the use of ICT in primary schools will only be possible if it is supported by firm education policies and effective professional development of the teachers who are the drivers of the innovation in the classroom (UNESCO, 2012). Hence, it was felt that the role of ICT in education should be discussed in this chapter.

Indeed, based on the model of the Singaporean experience, the Mauritian government has a vision of promoting its country as a 'cyber island', a regional hub in Southern Africa (Isaacs, 2007). Since the late 1990s, Mauritius has attempted to foster ICTs in schools and this is clearly indicated in its national policy. Admittedly, during a press conference in January 2018 (GIS, 2018), the Minister of Education of the country stated that the world of today is ruled by

technology in different spheres and it cannot be disconnected from our education system and training. It was emphasised that there is an urge to promote ICT in the education sector. Education is associated with the young generation who are called digital natives because ICT has invaded their lives in a totally different manner (Prensky, 2001). The digital natives are born in age where technology dominates the environment, be it smart phones, the smart TV, the tablet and many others (Prensky, 2001).

The Mauritian government affirmed that 'the education system of the country should ensure that the Mauritian youth gets access to technology and acquires the necessary competencies to be at par with their foreign peers and use the modern tools effectively' (GIS, 2019, p. 1). In short, technology is being viewed as a key facilitator in the transition from a knowledge-based to an information-based society. There is no doubt that school learners will need to develop skills to use technology to communicate or collaborate in their future careers. Hence, it is of prime importance for students to be comfortable using ICT tools. This era suggests exceptional opportunities like 'interactive projectors' in classrooms, and the use of tablets to allow learners to learn with technologies in the classroom. Nevertheless, at times, it can be intimidating for teachers and learners to take the plunge into the pool of digital technologies as the introduction of the latter in education is quite recent with not much research having been conducted that could inform their use in classrooms.

According to the NCF (2016), the main emphasis revolves around the use of technology to enhance teaching and learning, and help learners to develop the 21st-century skills and competencies for a future deeply rooted in technology. The NCF also makes provision for holistic development of learners to be able to function properly in the society. Furthermore, the ministry's mission and vision are probably to promote the use of technology in schools because this is the current mantra. In fact, few projects undertaken by the Ministry of Education could be used to illustrate Mauritian initiatives to promote the use of ICT at primary school level. Among these initiatives, in chronological order, there was conceptualisation of an ICT lab and curriculum in early 2000, the training of ICT teachers in the same year, and the Sankoré project, which started in 2011. The

first two initiatives cited above are linked. They involved the need to reform the primary curriculum in light of the world trade regime. The aim of the Sankoré project was to digitise the primary school curriculum with the view of equipping the learners with the necessary skills needed in the digital age. The next section is a detailed description of the Sankoré project on which this study is based.

1.4.3 The Sankoré project

The preceding section described the broad Mauritian context. The next two sections are dedicated to the more specific contexts of this study: firstly, the Sankoré project described here and secondly, the digital primary classroom. The 'Sankoré project' (also referred to as 'the project'), follows a declaration made by the former French President, Nicolas Sarkozy and the former British Minister, Gordon Brown, at the Franco–British summit of March 2008 (MIE, 2011). The aim was to help Africa achieve the 'education for all' goals through digital empowerment and using innovative technology. Following the summit, the French government established the *Delegation Interministerielle à l'Education Numérique en Afrique* (DIENA) in order to achieve Millennium Development Goals concerning education. In this context, the DIENA launched the Sankoré project to enhance educational practices using technological advances, more precisely the Interactive WhiteBoards (IWBs). The project consisted of empowering teachers and other stakeholders (headmasters, resource designers, administrators) in the education sector to create and use digitised learning resources on the interactive projector.

Mauritius was probably chosen to be part of the Sankoré project because the country was a former colony of both Britain and France. The Sankoré project in Mauritius, which evolved into a programme under the Ministry of Education and Human Resources, aims to democratise technology in its instrumental dimension and to empower teachers and other stakeholders in the education sector to create, use and share digitised educational resources through the initiation of the culture of ICT in education starting from the primary level. The project commenced in April 2011 with the receipt of a first wave of equipment, namely interactive projectors and laptops, from the French government. A second set of 250 projectors was received by the Ministry in April 2012.

A specific organisation, a team called the ‘Learning Factory’, was set up at the MIE for the implementation of the project. The mandate of this team was, among others, to digitise the primary school curriculum. Indeed, primary school teachers were provided with digitised resources through platforms and other mediums. These technologies included the hardware (the IWB, laptop and interactive stylus) and the software (interactive, digitised learning resources). These digitised learning resources, which are re-usable, can also be enhanced (remixed and re-edited) by the teacher to suit the learning context. With time, the training of teachers evolved. The roles of teachers were reconceptualised as resource creators rather than mere recipients of digitised learning resources from the MIE. Hence, teachers were empowered to design and develop their own digitised learning resources during training sessions. The Sankoré project was introduced to all Grade 4 classes of the primary schools in Mauritius in 2012 and eventually migrated to other classes in the following years.

The introduction of Sankoré implied that there could be new modes of teaching and learning. It was noteworthy that project implementers first encountered both resistance to change and eventually acceptance. Moreover, MIE, the main digital resource developer, worked in close collaboration with teachers as curriculum resource developers. Indeed, it was the first time in Mauritian primary schools that learners were using technology to learn in their traditional classroom situation. Prior to Sankoré, learners were using digital technology in the ICT lab, separate from their usual, everyday classroom and ICT was a ‘subject’ at that time rather than a tool to facilitate learning.

Hence, the novelty of the situation in Mauritian primary school classrooms opens many avenues for research. This possibly indicated a hybrid situation whereby the traditional classroom set-up integrated digital technologies. Therefore, the mix of traditional classroom set-up and technology could generate an amalgamation of new conceptualisations of classroom transactions such as learners’ learning.

1.4.4 The digital classroom

This section provides further details of the specific field of the study: the digital classroom. The proliferation of new inventions and technologies could be slowly changing the way teachers teach and how students learn. Figure 1.2 illustrates an ideal digitised classroom setting. Unlike the traditional classroom where students are seated in rows, in the ideal digital classroom the learners are seated in groups and are able to view the digitised resources or board from different angles. This ideal digital classroom setting makes the environment more conducive for learning. As shown in Figure 1.2, in the ideal digital classroom, the teacher explains the concepts and the interface of the IWB is projected on different sides of the class. Thus, the learners are able manage their own learning and also develop 21st century skills. The role of the teacher is that of facilitator rather than transmitter of knowledge in an ideal digital classroom.

Figure 1.2: An ideal digital classroom

However, in Mauritian primary classrooms, this is not actually the situation. The learners are still in a traditional classroom set-up where they are seated in rows facing the whiteboard but the modes of teaching and learning have changed to an innovative one through the use of the interactive projector. Figure 1.3 shows a Mauritian digital classroom.

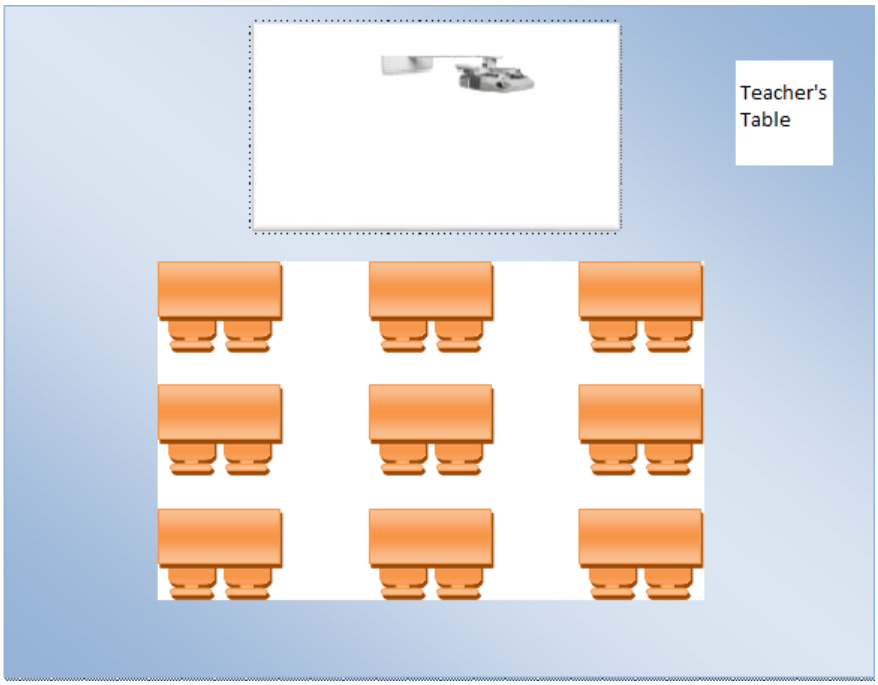


Figure 1.3: A Mauritian Digital Classroom

Figure 1.3 illustrates the seating arrangement of learners in the Mauritian digital classroom. It can be noted that it differs a lot from an ideal digital classroom. In Figure 1.3, students are seated in rows and one interactive projector is placed at the top of the main whiteboard, which is situated at the front of the classroom. The actual Mauritian classroom thus favours a more traditionalist ideology promoting teacher-centredness, whereas an ideal digital classroom promotes more learner-centredness through a progressivist ideology.

Further, since the interactive projector makes the whiteboard become interactive, the diametrically opposed dimensions might cause confusion about how the learners perceive learning through technology. This is where learning in a metamodern era triggers different opinions concerning the use of technology in traditional classroom situations. Some learners might embrace learning through technology while others might doubt its effectiveness. The study addresses this gap by showing why learners are learning in the way they do in a digitised classroom, thereby increasing the body of knowledge in terms of learning in the metamodern world.

1.5 The rationale of the study

Learners in this new generation have access to virtually unlimited information (Pick, Begley & Augustine, 2017). In the 21st-century classroom; learning is no longer about just recalling or memorising facts; rather, it has shifted to learning that is more functional. Dewey (1938), a great philosopher, advocated that an educational structure makes a balance between the child and the curriculum. It was stressed that emphasis should not only be laid on delivering knowledge but also taking into account the interest and experiences of the student. Much attention was paid to concepts of 'instrumentalism' in education and on 'learning by doing or hands-on learning'. Dewey (1938) argued that ideas are seen as instruments for the solution of problems encountered in the environment. It was believed that people learnt best through experience. In the same line of thought, it may be said that the 21st-century learners can also learn best through experiences in their environment (Roberts, 2003). These learners possess certain characteristics that are the requirements for the new millennium. The main aim of education is to educate the 21st-century learners to become productive citizens in a democratic society and in the 21st-century workplace. This undoubtedly poses new challenges to the teachers and learners. Remaining in the traditionalist ideology and planning lessons using traditional pedagogy does not do justice to the ways learners in this new generation learn as argued by John Dewey (1938):

> *'If we teach today's students, as we taught yesterday's, we rob them of tomorrow.'*

This thesis was motivated by a keen interest in exploring the dynamics involved in the learning process in the digital age. It has been argued that there is a need for change, which is relevant to the 21st-century context, but the process of learning has yet to be investigated to actually get a better grip into how to meet the needs of the 21st century (Groff 2013). This is where the study addresses the gap by providing a deeper understanding of learners' learning through the digitised learning resources in Mauritian primary schools. Analysing the way learners make sense of the concepts through the digitised learning resources

brings in a practical, scientific and theoretical or artistic dimension to the design of digital resources to be used in Mauritian primary classrooms. It can also be beneficial for curriculum developers both at micro level (classroom level) and at macro level (national level). The outcomes of this research can be ploughed back into the design of the NCF that emphasises the development of 21st-century learning competencies.

Furthermore, doctoral studies have personal and academic motives. On a personal level, the author was a primary school teacher for seven years in Mauritius before joining the MIE in 2009. The researcher's experience as a primary school teacher has influenced the work as an academic in curriculum, assessment and evaluation. During time spent in primary schools, the author witnessed the implementation of ICT in the primary school curriculum, for instance, the setting up and implementation of computer labs at schools. The computer laboratories were managed by ICT teachers who had the responsibility of integrating ICT in the curriculum (NCF 2016). Learners visited the laboratories on a weekly basis for ICT lessons. These lessons were not only focused on integrating ICT into subject areas such as French, Sciences and Mathematics, but also on basic ICT skills such as handling a mouse and keyboard skills. As such, ICT was conceptualised as being separate and distinct from the classroom; it even had a special room and ICT teachers did not have the same working conditions as general purpose teachers and they were not fully fledged teachers employed by the Ministry of Education (MoE).

Eventually, the researcher's interest in ICT in education grew since being a primary school teacher. The researcher believed that learners were living in a different age, namely, the digital age, and therefore in some way or another, had to be exposed to digital tools. At that time however, the researcher had little notion of how learners could learn through digitised learning resources. When the researcher was still a primary school teacher, the researcher had the opportunity to enrol for a Master's degree in Computer Mediated Communications and Pedagogies (CMCP) at the University of Mauritius (UoM). These studies helped the author to have better grounding in how people were learning with technologies. This is when the researcher's comprehension of

learning theories began and was consolidated. The researcher has built upon it since then and eventually joined the MIE as an Open and Distance Learning (ODL) Assistant in 2009, and was assigned the task of deploying online learning courses for teacher education. Later, as an academic in the field of Curriculum Studies and Evaluation, and given familiarity with the three domains, namely technology, primary school context and academia, the researcher was able to better probe deeper into analysing learners' learning through technology.

Indeed, it was a promising era. A few months into the author's academic career, the MIE, through the Centre for Open and Distance Learning (CODL) was entrusted with the implementation of the Sankoré project. Being a former member of the CODL, the researcher was quite conversant with the project. The researcher's academic and professional background provide a better understanding of the processes involved as well as the implications of using digital learning materials in the classroom. The researcher also had the opportunity to participate in training sessions and occasionally used the IP while teaching . Thus, the interest in digitised learning resources seemed natural. The researcher asked many questions about the project. One of them was how learners learnt with digitised learning resources. As a keen observer of what was happening. The researcher probably was no longer considered as an insider of the CODL. This could have possibly resulted into better observation of the Sankoré project activities without the pressure to meet institutional deadlines of resource development. The first observation was that the interactive whiteboard (IWB) (which was in fact an interactive projector making the classroom wall become an interactive space) had a considerable 'wow' effect on teachers and learners (and the researcher). The wow effect influenced the researcher to study learners' learning with digitised learning resources. The researcher therefore drafted a doctoral proposal in line with learners learning with digital resources, having in mind that the study could bring new knowledge on learning in the digital age.

1.6 The theoretical framework of the study

Technology has invaded our lives so much that we cannot even think of a day without using a technological device. Even in our small tropical island, Mauritius, technology is gaining ground. Ranging from primary to tertiary level, many classrooms are equipped with technology and the educators have no other option than to align their teaching for the 21st-century learners. The primary classrooms are equipped with interactive projectors (IPs), which transform the static whiteboard or even walls into interactive surfaces.

At this stage, key observations that have shaped the choice of theoretical framework of the study must be stated. At first, it seemed that the classroom ('classroom' here means the classroom dynamics, the teacher, and the learners) had changed with the introduction of a new actor: technology. The technology was no longer separate from the teachers and the learners in the way the ICT laboratories had been. The IP was in the classroom and the researcher believed this was a very important aspect to consider in an attempt to understand how the actors dealt and transacted with it. The technology here is qualified as a non-human actor by Latour (2012). With time, the researcher formed a diametrically opposed view of the above and felt that the classroom had not changed at all. It was still the four-walled classroom emanating from mass education systems (Thorsen, 2010). Indeed, the IP was used the same way as during frontal teaching (Udhin et al., 2016). The classroom was still teacher-led and students submitted to this lead. When the researcher observed teachers that had gone through training sessions with the CODL, a similar pattern was noted. Teachers had to move from traditionalism in their teaching methods and abruptly move to teaching with technology. Traditionalism in teaching could be related to expository methods (Killen, 2000) and teacher-centredness. Not all teachers were comfortably embracing this shift in the methods of teaching.

In fact, teaching with technology involved an altogether different set of methods that focus on creativity, dialogic relationships and collaboration among actors of the classroom that included technology. These oscillations between diametrically opposed positions led to considering metamodernism as a theoretical framework.

Metamodernism has attempted to move beyond postmodernism. This is why it is often described as post-postmodernism. More precisely, metamodernism could reflect a state of affairs where the modern and the postmodern exist in a single environment or within a single sphere of social interactions such as a classroom. Indeed, the classrooms that the researcher has observed under the Sankoré project possibly resonated with metamodernism whereby the modern (classroom structure, teacher and learner roles and expectations, pedagogical techniques) co-existed with the postmodern (technology and new pedagogical possibilities). In this study, learners' learning through technology was the focus. The theoretical framework is further detailed in Chapter 3 of the thesis.

1.7 The research methodology of the study

The researcher's interest was to study how learners variously interacted with the digitised learning resources to learn the specific concepts of the lesson. As a result, the research design was crafted in line with metamodernist thought. Since the researcher has endeavoured to study learners' learning from the learners' perspective, she has attempted to capture the learners' beliefs about their learning (through the research design and methodology).

The research is a qualitative study located within the interpretive paradigm. 'Qualitative research is concerned with qualitative phenomenon involving quality or kind' (Kothari, 2004, p. 16). Qualitative studies are specially used to discover the underlying motives of human behaviour and are concerned with subjective assessment of opinions, attitudes and behaviour, (Kothari, 2004). It is a social inquiry that focuses on the way people interpret and make sense of their experiences and the world in which they live. The study sought to explore and interpret the learning experiences of primary school learners within a digitised classroom.

Through the chosen methodology, the researcher tried to analyse the naïve sincerity of learners' beliefs about their learning, endeavouring to capture the conceptualisations of a complex phenomenon (learning) through the simple expressions of young minds. The researcher analysed the children's constructions of knowledge and understanding through their representations

(drawings in this case) of the concepts learnt in the lesson taught with the aid of digitised learning resources. The qualitative analysis of the phenomenon, that is learning helped to discover new forms of learning in a metamodern era where the views of the use of technology differ paradoxically. However, as mentioned above, the metamodern condition may involve the co-existence of opposites. The learners' creative expressions, as creative amateurs (Latour, 2012) have been eye-openers in the study and helped the author to understand learners' learning with digitised learning resources. Furthermore, metamodernism does not imply a rejection of the past. Indeed, it would be difficult to know about the future without signposts from the past (Smith, 2018). The researcher therefore built up from the "past" in the literature review. The literature review in Chapter 2 will describe in some detail the conceptualisations of learning from different eras.

1.8 Key elements foregrounded in the research

1.8.1 The digitised learning resource

Since the digital technology referred to in the thesis is a digital learning resource (DLR), the author believes it is necessary to provide a brief explanation of the concept of digitised learning resources. Digital technologies are omnipresent in our everyday lives and we cannot ignore the possibilities that they offer to schools compared to traditional learning resources (Fallon, 2016). Notably, the term 'learning resources' has been chosen intentionally to indicate the difference between the artefacts and the traditional textbooks. According to Alexander et al. (2006), a DLR is both an artefact and a semiotic tool with a bigger potential than traditional textbooks. This learning resource can actually engage, inspire and excite learners of diverse ages, abilities and needs (Becta, 2008). The DLRs differ largely from the traditional textbooks in myriad ways. One of the main differences is that the digitised learning resources consist of features that can promote both visual and auditory communication, often referred to as multimodal (Alexandersson et al., 2002). Moreover, the DLRs can incorporate visual representations in digital format such as still pictures, digital photographs, short videos or rich animated demonstrations. Indeed, these digitised learning resources can also be constructed as simulations, which can be a representation of the concepts in a topic. Figure 1.4 shows an example of a DLR that explains

the stages of water cycle. It includes animations that display the different processes involved in water cycle.

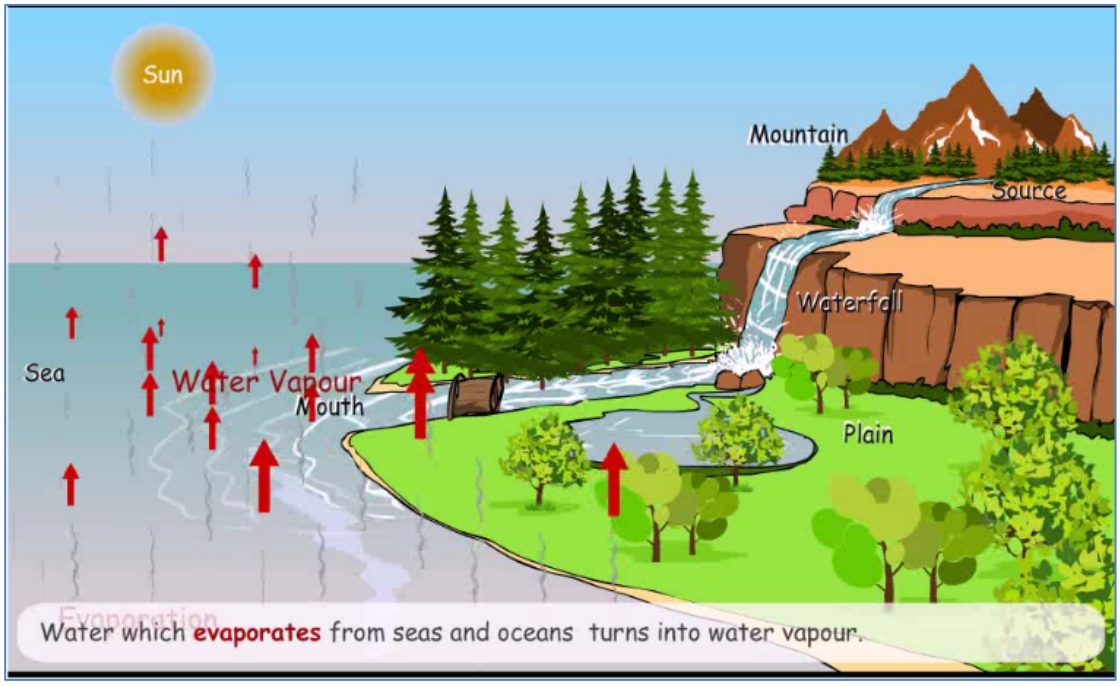


Figure 1.4: An example of a DLR on water cycle

'In education, a digital resource is anything which can be stored in a digital format and adopted or adapted for use in learning' (Becta, 2008). The digitised learning resources should, in most situations, support inclusive practices in their design (Becta 2007). This can be made possible by allowing flexibility and adapting the resources to address the preferences and needs of different learners to attain the learning objectives (Becta 2007).

However, the big digital technology debate still focuses on the question: 'Is digital technology making fundamental changes to teaching and learning, transforming it in ways which were unimaginable before the advent of the internet?' (Thomas & Morris, 2017, p. 1). Thomas and Morris (2017) argued that with the widespread advent of the internet, learners are now able to better learn through their interactions with the learning contents provided by their teachers, peers and organisations. They added that this fundamental shift in education allows greater accessibility to learners, especially to those who previously found it difficult to enter formal education. Moreover, Thomas and Morris (2017) also advanced that there are three main things that digital technology actually contributes for the change to happen: firstly, flexibility of learning; secondly, change in the way

learners gain knowledge, skills and competencies through the aid of technology; and thirdly fundamental change of interactions of learners with peers and educators. They pointed out that 'digital technology is enabling teachers to create more interactive, engaging, and flexible learning materials' (Thomas & Morris, 2017, p. 2). Further, they argued that the drivers for change in education were mainly socio-economic alterations in job markets, the currency of a degree and the required skills people need. They put forward that we need to understand what drives the use of technology, otherwise we will put effort into areas that are not going to gain traction.

Very often, we believe that digital technology is the 'magical pixie dust' that solves all the problems. In fact, the real change lies in the enablers who will need to demonstrate the ability to create the digital material, and include the right instructional designs into the course design and development' (Thomas & Morris, 2017, p. 2). This study helped in providing a deep understanding of the process of learning using the digitised learning resources in a developed country.

1.8.2 Learners' learning

The conceptualisation of learning under the umbrella of ICT-enabled learning environment is experiencing major paradigm shifts (Majumdar, 2015, p. 2). Learning using ICT can range from mobile learning, online learning, distance learning, artificial intelligence and augmented reality. Unlike in earlier years, when learning was associated with more adaptive methods, for example, learning through facts, drill and practices, in today's world, learning is more creative and authentic (Majumdar, 2015, p. 2). Nowadays, the shift is towards project-based or problem-based learning, inquiry-based learning and discovery learning which perfectly fit the demands of the present world, which focus on holistic development of individual. 'The main hallmark of this paradigm shift is from a teacher-centred type of curriculum to a more learner-centred type' (Majumdar, 2015, p. 2). The 21st century learners are no longer the passive recipients of knowledge and the teacher the sole depository of knowledge. In fact, the learner could be becoming an autonomous learner rather than a dependent one, and the learner could be more active in his or her learning and take ownership of that

learning by being a producer of knowledge instead of a reproducer of knowledge (Majumdar, 2015).

Twenty-first century learners should develop 21st century skills and competencies, which are multifaceted and valuable to face the complex challenges of today's and the future world. It was felt that it was important to draw the distinction between skills and competencies, which very often are used interchangeably. 'A competency is more than just knowledge or skills. It involves the ability to meet complex demands, by drawing on and mobilising psychological resources (including skills and attitudes) in a particular context' (OECD, 2003, p. 4). Notably, a learner needs to develop both the skills and the competencies to meet the demands of the society. According to international frameworks, the 21st-century competencies that have proved to offer measurable benefits in various facets of life are critical thinking, communication, collaboration, and creativity and innovation (NCF, 2016). Research has proved that there is a need for today's learners to engage in 'deep learning', that is the interplay of the cognitive, interpersonal and intrapersonal spheres. Deeper learning results in knowledge and skills, which are transferable (Ontario, 2016). The perfect vehicle for facilitating the development of the different skills could be technology but it should be made clear that it is not about how to use technology but rather how learners construct and create knowledge with the support or aid of technology (Kolk, 2011). Kolk (2011) claimed that a '21st-century classroom must prepare all students to be active participants in our exciting global community' (p. 1).

Figure 1.5 illustrates the different skills that the learner can develop in a digitised classroom.

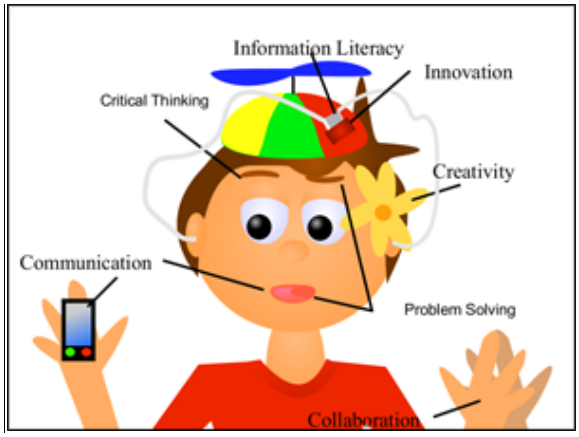


Figure 1.5: Skills required in a digitised classroom

Source: Kolk, 2011

A 21st-century classroom must engage with and energise both digital natives and non-natives, making all students become active participants in this global community (Kolk, 2011, p. 1). Besides concentrating on the three Rs – reading, writing and arithmetic, the 21st-century learners must also be able to fully master the 4Cs – creativity, critical thinking, communication and collaboration (Kolk, 2011, p. 1). In the digital classroom, teachers should help learners to uncover information. To be able to promote those 4Cs in our classroom, there is an urge to understand in depth how learners learn in this new century that will ultimately inform how to teach. This is where this study of learners' learning through digitised learning resources provides important information that will help in today's teaching and learning process.

1.9 Structure of the thesis

The thesis is structured into five parts and eight chapters. Figure 1.6 provides an overview of the organisation of the chapters in this thesis:

1. Setting up the scene;
2. Conceptualisations and contexts of learning;
3. Researching learners in the digital classroom;
4. Analysing learners' learning through DLR; and

5. Learners' learning through DLR in the metamodern era

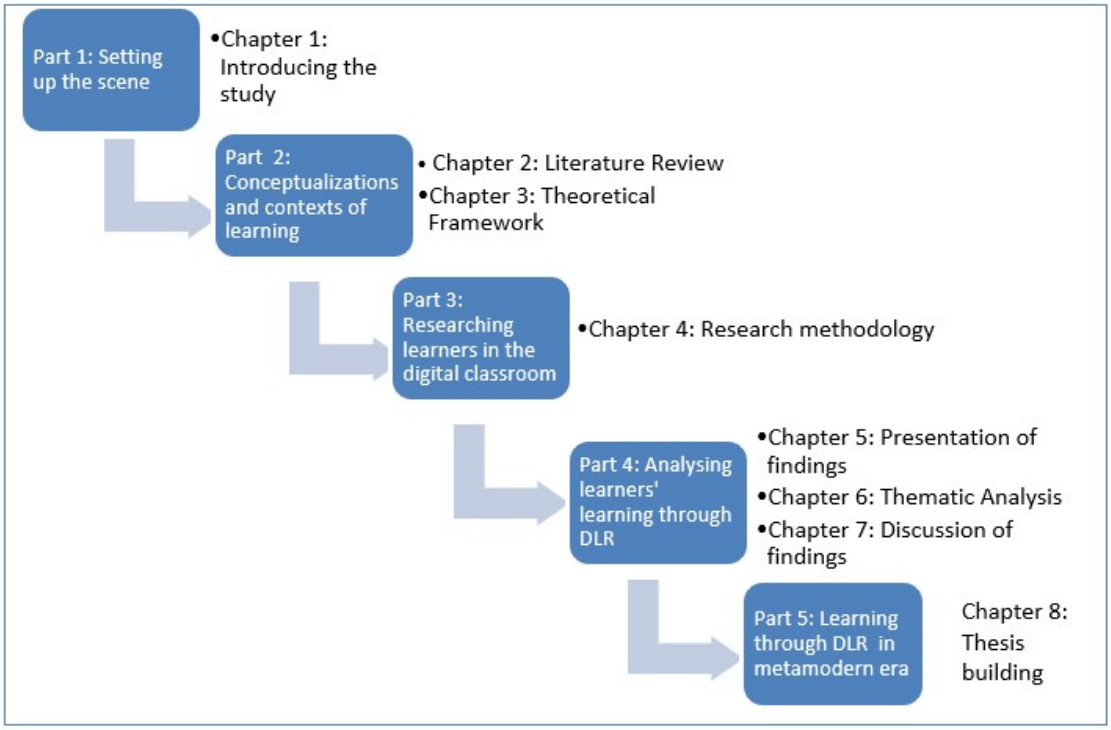


Figure 1.6: Organisation of the thesis

Part 1: Setting up the scene

Chapter 1 is the introductory chapter that sets up the scene. It provides the reader with a glimpse of the thesis. It unveils the rationale underpinning this research. It also puts forth the key research questions. Indeed, the background section introduces the main building blocks of the study. It presents a snapshot of the country's profile as well as the education system, including the inclusion of technology in Mauritian schools. It also briefly explains the digital age by expanding on the debates around views of learning with technology in different eras, connecting to the metamodern era. An explanation of the different concepts involved in the study is included to give the reader a better indication of the main orientation of the thesis.

Part 2: Conceptualisations and contexts of learning

This is dealt with in two chapters, namely Chapter 2, which is the literature review, and Chapter 3, which describes the theoretical framework. The literature review chapter includes in particular the different types of literature review and justification of the choice of the type of literature review for this thesis. In addition, present in this chapter is a detailed discussion of the evolution of learning over different eras, namely, the premodern, modern and postmodern and beyond postmodern era. The discussions on the theoretical underpinnings and conceptualisations of learning in the different eras are presented. A critical discussion on children's learning and development is also included in this section to provide the reader with a review on how learners from eight to nine years old actually learn. This section ends with a discussion on learning and learning styles where two models of learning styles were selected to debate around the topic.

Part 2 also presents a detailed explanation of the theoretical framework informing the study, which is metamodernism. This chapter explores some of the tenets of metamodernism such as those of Toth (2010) and Vermeulen and Van den Akker (2010). The discussions of learning from the perspectives of these authors are deemed important as they enabled the researcher to probe deeper into investigating into the process of learning. This discussion about the theoretical lens to analyse learning serves as a link to the next part of the thesis, which is researching learners in the digitised classroom.

Part 3: Researching learners in the digital classroom

Chapter 4 introduces the research design and methodology employed in the study. A description of the selection of the participants for the study is given in this section. This chapter includes a detailed explanation on the design of the instruments used for the research and gaining entry into the field. The ethical considerations for this study and a description of the procedure used to analyse the findings are also addressed.

Part 4: Analysing learners' learning through DLR

Chapter 5 presents the findings of the research through short stories of participants. The data obtained from different sources were compiled and presented creatively in the form of stories. The learners' learning through digitised resources were foregrounded authentically within each short story.

Chapter 6 presents thematic analysis drawn from cross-case analysis of the short stories of the participants to bring out the series of influences affecting their learning through digitised resources. While some characteristics of learners echo throughout the short stories, there is evidence that the learners' learning was unique for each learner.

Chapter 7 constitutes an analysis of the findings and discussion relating to the literature review and theoretical framework. Moreover, a discussion of findings from three antithetical cases and the binding forces is presented. The chapter ends by drawing initial conclusions from the study and answering the first and second research questions.

Part 5: Learning through digitised learning resources in the metamodern era

Chapter 8 builds on stages of learners' learning through digitised resources. An analysis within the context of the study gives a conclusion to the study and the new knowledge produced. Moreover, the theoretical, conceptual and methodological contributions of the study are explained. A personal and professional reflection are also presented in this chapter. The chapter ends by suggesting possibilities for further studies and a conclusion to the whole thesis.

1.10 Conclusion

This chapter set the scene of the study and clarifies key elements related to the study, namely learners' learning and the digitised learning resources. It then presented the rationale for conducting the study being at personal and professional levels. Besides, the phenomenon, purpose and focus of the research were made clear. The research questions that guide the study were

also set out. It also presented a profile of the country for the reader to get an insight into the background and context of the study. Furthermore, the educational system in Mauritius is described as the study was conducted in Mauritian primary schools. A description of the Sankoré project provided the reader with a clear idea of the introduction of the digitised curriculum in the Mauritian education system. A structure of the whole thesis is presented by providing brief synopsis of each chapter. A discussion of learning will be the focus of the next chapter.

Part 2: Conceptualisations and contexts of learning

Chapter 2: - Literature Review

2.1 Introduction

The previous chapter discussed the focus and the critical questions pertaining to this doctoral research. The different notions of learning in the 21st century were introduced and the different meanings of terms used in the research have been explained. Besides, a snapshot of the country profile and the education system in Mauritius were also given to provide an insight into the context within which the study was located. In the previous chapter, the need for investing in technologies that could transform the learning environment was emphasised, especially in documents such as the NCF (2016). This study aims at providing a deep understanding of learners' learning through digitised learning resources. Therefore, this chapter discusses several conceptualisations and theories of learning that resonate with this study.

A literature review is the foundation of a research thesis. The importance of a literature review rests on an assessment of the previous and current literature on the research topic. It helps to position the researcher within the academic conversation in the field. The literature review presents an overview of the ideas, theories, and pertinent literature currently published on the topic (Sally 2013; Hart 2018). According to Gall and Borg (1996) and Randolph (2009, p. 2), the literature review plays a role in 'delimiting the research problem, seeking new lines of inquiry, avoiding fruitless approaches, gaining methodological insights, identifying recommendations for further research, and seeking support for grounded theory'. This literature review incorporates all of the above roles as some parts of the review deal with learning through technology, thereby delimiting the research problem. It was essential for the readers to have a deep understanding of the literature on learning to have a better understanding of the phenomenon. Hence, the purpose of this chapter is to arrive at a thorough understanding of learners' learning.

This chapter presents a short history of learning and an informed explanation of theoretical perspectives of learning over different eras. Moreover, the researcher sought new lines of inquiry with regard to learning over different eras. It was chosen to present the body of literature on learning in relation to its evolution in order to show the professional grasp of the phenomenon as well as to highlight the deeper underlying evolution in thinking about learning over the eras. Hence, this part of the chapter revolves around four main sections namely: learning in the premodern, modern, postmodern and post-postmodern eras. The discussion helped to gain a deeper insight into the theoretical framework for the study. The literature review chapter shows that conceptualisations of learning evolve over time (and with technology). One of the major gaps identified in the literature is an understanding of learning in the metamodern era. A deeper discussion of the metamodern era and the construct metamodernism are thus presented in the next chapter.

Conceptualisations of learning range over eras, sometimes spanning hundreds of years and a myriad of contexts. Concerning the context, since learning occurs as a result of a social framework, the researcher felt it important not to separate information, theories and principles from the activities and situations within which they are used (Brown, 2001). The premodern, modern and postmodern era describe the situations in which learning occurs across different periods. Over time, technology has changed the way human communicate or collaborate, thereby changing one's perspectives on learning. In this chapter, the researcher tries to make a case from pertinent literature on the shift in thinking with regard to learning across different eras. 'Learning could be viewed differently in different social contexts as knowledge is intricately situated within the physical and social context of its acquisition and use' (Brown, 2001, p. 1).

The major theories of learning and child development are usually called 'grand theories' or 'grand narratives'; they endeavour to research every aspect of development. These grand theories of learning are mainly behaviourism, cognitivism and constructivism, which are discussed in Section 2.2 in this chapter. There are also other levels of theories called mini or middle theories, which emphasise specific aspects of development; they often refer to cognitive

or social growth and they are usually drawn from the grand narratives (Cherry, 2019). In Section 2.3, attention is given to how children of age group eight to nine learn and the middle theories that are drawn from the work of Erikson (1968), Montessori (1967) and Egan (2001). The reason for choosing to discuss these authors' point of views is that their theories are regarded as the major child development learning theories also considered as middle theories. Adding to the above, a choice is also made to approach learning from the constructs of learning styles in Section 2.4.

According to Kolb and Kolb (2005), the concept of learning styles depicts individual differences in learning. Due to diverse life experiences and the demands of the present environment, each individual adopts a preferred way to learn and the concept of learning styles helps describe this. Since this thesis focuses on learning, and the fact that learners have varied learning styles and strategies, it was felt to be important to discuss the preferred ways that learners adopt to learn the concepts through digitised learning resources. According to Kolb (1984) 'learning style is the process whereby knowledge is created through the transformation of experience' (Stokholm, 2014, p. 270). In the case of this study, learners learnt through their favoured learning styles along with different occurrences in the digitised classroom. Situating learning through different learning styles better explained how the learners were learning the concepts through digitised learning resources and why they were learning in such ways. More discussions around learning styles and learning are presented in Section 2.3 of this chapter.

2.2 Evolution of conceptualisations of learning

Psychologists and educators have long been interested in understanding how people learn, as the concept of learning is the cornerstone for different human endeavours (Harasim, 2012; Borich, 2019). 'Learning' is a term that is used very often in everyday life but within the field of educational psychology, the term learning refers to a systematic process in which an individual experiences permanent, lasting changes in knowledge, behaviours or ways of processing the world (Goodfriend, 2014, p. 1). Learning is a very broad concept that is not limited

to the acquisition of knowledge (Lloyd, 2017). It also involves evolution of skills, insights, etiquette and experiences. Most of the time, the learning process is facilitated by someone with greater experience of the topic than the learner. That person can be the teacher, parent or role model (Watson, 2017). Smith (2017) added that learning can also take place through observation and be self-taught. For example, an individual can learn from one's own mistakes by self-assessing. In brief, learning is the acquisition of skills and knowledge through teaching or self-exploration (Smith, 2017). Moreover, learning can happen at any age but the speed of learning depends on the motivation of the learner. This motivation can be enhanced by the dispositions that the teacher puts in place. Goodfriend (2014) argued that learning does not simply refer to the learner's ability to memorise or rote learn certain pieces of information but also refers to an ability to analyse, reflect and draw conclusions from pieces of information. The teachers act as facilitators, guiding learners towards their own conclusions and deductions. From the above perspectives, learning emerges as a complex and active process shaped by the learners' contexts and other influences. Changes in contexts, cultures and beliefs over time lead to an evolution in the conceptualisations of learning.

To understand learners' learning in the digital age, the researcher feels it is important to understand learning in other eras as it presents an up-to-date awareness of the evolution of learning and helps to explain the shift in thinking with regard to learners' learning. Moreover, this segment of the chapter provides a backdrop for the reader to conceptualise the context within which the located study could be positioned.

The literature in the field of learning in the educational arena is vast, with various possibilities within the classroom context. With respect to this, the following discussion is presented in such a way to attain two significant outcomes. First, the discussion sets a platform to explore the different conceptualisations of learning by outlining the major learning theories noted in the literature consulted. Second, the discussion focuses on the social, cultural and educational aspects of learning. In light of these complexities, the discussion also attempts to provide an account of traditional views of learning, and how such views have come to be

scrutinised in pursuit of viable alternatives to teaching and learning strategies used for meaningful learning to take place among learners in different contexts. Moreover, this section serves as a roadmap for the way in which different conceptions of learning have evolved over time, and how this shift in learning has come to influence the present modes of learning within the education arena. It unfolds in a chronological manner, describing one theory of learning after another. As mentioned previously, the chronological markers that have been used are premodern, modern and postmodern eras. Table 2.1 is an illustration of the idiosyncratic partial timeline over these different eras:

Table 2.1: Historical eras – An Idiosyncratic Partial Timeline

Historical Eras - An Idiosyncratic Partial Timeline			
125000 BCE	Emergence of homo sapiens sapiens	PREMODERN	Prehistoric Era
65000 BCE	Bone tools created in Africa		
35000 BCE	Fish commonly used for food		
9000 BCE	Cultivation of grains; proto-city of Jericho		Emergence of Civilization
7500 BCE	Proto-city of Catal Hoyuk		
5300 BCE	Cities of Sumeria		
4500 BCE	Invention of the plow		
3500 BCE	Domestication of horse		
3110 BCE	Earliest written records		Ancient Era
530 BCE	According to legend, Pythagoras, Mahavira, Confucius and Buddha are all alive at this time		
395 CE	Last united rulership of Roman Empire ends		
440 CE	Drowning of the city of Ys		Late Antiquity in Transition
632 CE	Death of Mohammed		Start of the Middle Ages
1085 CE	Reconquista, fall of Toledo		High Medieval Era
1244 CE	Fall of the Cathar citadel at Montsegur		
1453 CE	Fall of Constantinople		Renaissance and Age of Exploration
1620 CE	Battle of White Mountain	MODERN	Beginning of the Modern Era
1623 CE	Modern patent systems introduced		
1626 CE	Death of Francis Bacon		Puritan Era
1632 CE	Galileo's relative motion theory		Start of the Enlightenment
1727 CE	Death of Isaac Newton		Beginnings of Industrial Revolution
1776 CE	American independence; Adam Smith's *Wealth of Nations*		Maturity of Enlightenment
1799 CE	Napoleon assumes dictatorship		and Early Romantic Era
1811 CE	Luddites smash industrial machines in England		Maturity of Industrial Revolution
1838 CE	Darwin's first notes on his theory of evolution		and Later Romantic Era
1856 CE	World's first large oil refinery built in Romania		Beginning of the Petroleum Age
1865 CE	Mendel's laws of heredity		
1905 CE	Einstein's Special Theory of Relativity		High Modern Era
1945 CE	Second worldwide war in 30 years ended by atomic bomb		
1948 CE	Shannon's information theory; Wiener's *Cybernetics;* invention of the transistor; television becomes a mass market phenomenon; Orwell completing *1984*	POSTMODERN	Beginning of the Postmodern Era
1962 CE	Kuhn's *Structure of Scientific Revolutions;* Cuban missile crisis brings world to the brink of nuclear war		
1964 CE	McLuhan's *Understanding Media;* Berkeley Free Speech Movement; Philip K. Dick's middle two "political" novels		
1975 CE	Feyerabend's *Against Method;* first personal computers introduced for the mass market		

Source: Connelly (2008)

The above idiosyncratic partial timeline proposed by Connelly (2008) demonstrates the events that occurred over the different eras where things became more complicated over time (Connelly, 2008). As we can notice, there were diverse forces in the different eras that may have influenced the way in which people conceptualise learning.

2.2.1 Conceptions of learning in the premodern era

The value of education and learning has constantly been changing since its conception. People have been trying to understand learning over decades or even centuries. It started far back as the Greek philosophers: Socrates, Plato and Aristotle (Noddings, 2019) but is still a subject of discussion with a diversity of opinions on how learning can be encouraged and sustained.

People in the premodern era expressed their sense of self and purpose through faith in some form of deity (Samuelson, 2002). Premodern cultures have not been thought of creating a sense of distinct individuality (Griffin, 1990). Education was considered as being the backbone of any country's development.

Socrates, Plato and Aristotle, three masters of classical philosophy, are often referred to as 'wisdom-loving discipline' as they provided us with knowledge that may still be considered in the postmodern world (Mares, 2018). Unlike his students Plato and Aristotle, 'Socrates believed that education is not a process of learning' and he argued, 'we must educate ourselves to remind us of our lost knowledge' (Mares, 2018, p. 120). Socrates's emphasis was not on teaching but on reminding the truth that is inside a person. He posited that employing questions and answers was one of the ways to awaken the truth within oneself (Mares, 2018). Socrates empirical evidences in the research were not gathered in educational institutions but in outdoor open spaces like gardens and streets. However, later Plato came with a more institutionalised concept of education, which was closely related to different virtues an individual should develop (Mares, 2018). Plato viewed education as teaching groups of people to maintain the balance linked to certain virtues. He took the examples of prudence for politicians and courage for soldiers (Mares, 2018).

Plato believed that if equal educational opportunities were given to early learners, all people could live in harmony (Mares, 2018). Moreover, Plato postulated that education was mainly for those who passed examinations for higher levels and those who did not pass the examination should be assigned an occupation. He did not believe that education was meant for all the persons in the society. Aristotle contested that point by emphasising that opportunities to study should be given to all citizens provided they are willing to study. His focus was on producing exceptional scholars, which would be beneficial for the society (Mares, 2018). Aristotle argued that education provides 'the model that helped in maintaining balance between body, mind and soul or synthesis of theoretical, practical and technical tasks' (Mares, 2018, p. 4). Furthermore, Aristotle also advanced that students should enhance quality of learning by learning through habits. Aristotle associated 'learning through reason' with 'learning through habits'. He argued that learning should be for life and we can notice that this conception of 'lifelong' learning still has its value in the 21st century. Moreover, both Plato and Aristotle emphasised shaping learners towards becoming good citizens, as for them, the term 'good' was related to virtues and a wisdom-loving society. The question that one might ask in the 21st century is whether the quest for 'good' still revolves around wisdom or virtues. In that era, technology was not available and the claims made did not consider how the learners would learn with technology. This study tried to address this gap by providing an analysis of learning through technology.

Furthermore, in the premodern era, during the Roman Catholic period (500 AD to 1500 AD), learning was mainly focused on memorisation and rote learning. According to Bhamani & Mehar (2014): 'Education in the premodern era laid emphasis on teacher-centred curriculum and orthodox education was primarily based on seeking knowledge from authoritative sources' (Bhamani & Mehar, 2014, p. 196). The source of knowledge was assumed to be driven by a spiritual script. Students had no right to challenge or create knowledge, as knowledge was considered divine and unchangeable (Bhamani & Mehar, 2014, p. 196). Therefore, the main conception of learning was transmission-based, whereby it was assumed that knowledge which was driven from absolute truth and

revelation. Students were viewed as passive recipients of knowledge and the role of the teachers was to transmit knowledge instead of educating learners. This method is also called a transitional method of teaching and it was the only prevalent one in this era. Philosophers in this premodern era did not consider the various factors that might influence the shaping of the learners' learning.

2.2.2 Conceptions of learning in the modern era

The modern era includes the early period, called the early modern period, which lasted from c. 1500 to around 1900 (most often 1945). Particular façades of early modernity include the Renaissance. The Renaissance marked the transition from the Late Middle Ages and Early Modern Times. During the Renaissance period (15th to 17th centuries), the conception of learning shifted from memorisation to inquiry- and discovery-based learning. Moreover, new perspectives were gained with the invention of the telescope and microscope, which expanded the borders of thought and knowledge. This era counted for significant development in the fields of science, politics, warfare, and technology and it was termed as the Age of Discovery and Globalisation (Baird & Kauffmann, 2008). Among the factors that shaped modernism were the development of modern industrial societies and the rapid growth of cities, followed then by reactions of horror to World War I.

Modernism rejected the certainty of Enlightenment thinking, and religious belief. Learning as the transfer of knowledge was questioned. Indeed, teachers were considered co-creators of knowledge, having the right to question knowledge. The main aim of the modern era was to unify the society to come up with equal values and realities across different cultures (Bahmani & Mehar, 2014). The prevailing school of thought was to allow learners to construct and use varied knowledge and information. The teacher-pupil rapport in classrooms improved as the learner was no longer passively absorbing knowledge but was rather actively engaged in the classroom. There exists a variety of theories to explain how people learn. It is important to understand the different theories of learning and their application and to evaluate the different arguments and relate them to the focus of the study.

Various theories of learning emerged in that era. Broadly speaking, learning was

viewed as a change in behaviour. Rene Descartes (1650) revived the platonic concept of learning by arguing that the environment and the mind can initiate behaviour (Strongman, 1995). The simplest form of learning is associative learning, which is the connection between events and environment. In a nutshell, the learning principle 'associative learning' means that the brain normally recalls information when they are grouped together and not in isolation (Spanella, 2018). Furthermore, Pavlov (1936) introduced the concept of 'classical conditioning', which involves learning by association: that is associating two events, which happen at the same time. He argued that the response could be conditional or unconditioned with the sole difference that the response is caused by a different stimulus. However, Thorndike (Strongman, 1995) contested the views of Pavlov by arguing that most behaviours in the environment cannot be explained by the latter's theory as it did not consider the complexities of different behaviours in the environment. Hence, Thorndike devised a new concept, which he called 'operant conditioning'. He argued that complicated behaviours are generated from anticipated outcomes and not by triggered stimuli (Schwartz & Lacy, 1982, pp. 24-26). Skinner (1950) further extended the notion of 'operant conditioning' by arguing that a behaviour which is reinforced tends to repeat itself and a behaviour which does not repeat itself tends to weaken and die out (Austin, Orcutt, & Rosso, 2001). He associated behaviour with reward as the positive reinforcement, which can be verbal reinforcement such as 'that's very good' or 'you are doing very well, keep it up'. He asserted that the removal of an unpleasant reinforcer can also strengthen the human behaviour.

Indeed, Pavlov's, Thorndike's and Skinner's experiments were focused on how behaviour was affected by forces in the environment and these theories of learning were called 'behaviourism'. Behaviourist learning theories have had considerable influence in education (Austin, Orcutt & Rosso, 2001) as they were useful for rote learning or learning through reinforcement and practice (Austin, Orcutt & Rosso, 2001). However, one gap in the research of these theorists was that they did not consider feeling, thoughts, emotions, intentions or mental processes and they were mainly experimenting on behaviours. Another weakness is that these theories were not derived from empirical evidences in real

classroom situations. They emanated from experiments carried out on animals and not on students in classroom situations. This is where this study tried to address these gaps by analysing how students were learning in real classroom situations in the 21st century and why they were learning in such ways.

2.2.3 Conceptions of learning in the late modern and postmodern era

2.2.3.1 Late modernity and learning

According to the Oxford Dictionary (2018), late modernity (late 20th century) is a term used by writers who do not accept that there has been a transition to a new societal stage of postmodernity, but who do wish to acknowledge that there has been a radical intensification of some of the tendencies of modernity. Giddens (2016) characterised contemporary society as 'late modernity' and it was argued that late modern societies were actually a result of the extension and development of the same social forces that structured earlier forms of modern social life. His arguments were based on the loss of tradition, social interactions and disembedding of time and space. In modernity and late modernity, advances in communication (electronic communication), transport and cultural systems facilitated interactions with limited time-space constraints. Unlike the premodern era, which was dominated by traditions, late modernity was characterised by tradition losing its power (Giddens, 2016). People in late modernity had greater ability to be reflexive about their social worlds by choosing who they want to be (Giddens, 2016). Like Giddens, Max Weber also shared the same point of view and he argued that premodern society was too largely compromised by traditional culture (Giddens, 2013). Late modernity was the period where individuals could take their own responsibilities and reflect on possibilities. The individuals were no more followers of traditions but started to question the 'self'. People started to understand their 'self-identity' and were actively engaged in shaping and reflecting on themselves. They were crafting their own biographical narratives as they went through life (Giddens, 2016).

During late modernity, cognitivism became the dominant force and replaced behaviourism (Bates, 2015). A criticism of behaviourism was that humans were treated as a 'black box' where the input was measured against the output rather

than considering what actually happened inside the ‘black box’ (Bates, 2015). However, cognitivism was not a total rejection of ‘behaviourism’ but an expansion of the latter. Cognitivists started to research inner mechanisms of human thought and the processes of knowing. Cognitivism shifted the emphasis to the learners’ ability to organise and process information, and link it to their prior knowledge (Ahlbrand, 2017). Instead of viewing the teacher as the transmitter of knowledge, cognitivists viewed the teacher as facilitator or guide for learners to structure their knowledge (Ahlbrand, 2017) with feedback being of prime importance as it helped the learner to think and process the information to gain knowledge. In brief, for cognitivists, information processing leads to understanding and retention.

One of the most widely used theories of cognitivism in education is Bloom’s taxonomies of learning objectives (Bloom, 1956). These taxonomies refer to various kinds of learning skills and ways of learning (Bates, 2015). Bloom (1956) argued that for learning to happen, it should involve three domains of learning namely the cognitive (knowledge), affective (attitude), and psychomotor (skills) and came up with a taxonomoy of learning. The Bloom’s Taxonomy consists of several layers classifying thinking into six levels of complexity (Bates, 2015). The six major categories of cognitive processes that were identified, ranged from simplest to complex: knowledge, comprehension, application, analysis, synthesis and evaluation. It was claimed that ‘the taxonomy is hierarchical and that each level is subsumed by the higher levels’ (Forehand, 2017). For instance, a student performing at application level should also master functioning at knowledge and comprehension levels (Forehand, 2017). The Bloom’s taxonomy has been used by educators to inform assessments and evaluations of students’ learning and curriculum development (Forehand, 2017).

In the mid-1990s, Anderson and Krathwohl revisited Bloom’s taxonomies of learning and brought in changes that reflected a more active and perhaps more accurate form of thinking (Anderson, Krathwohl, Airasian, Cruikshank, Mayer, Pintrich, Raths, Wittrock, 2001). The six new categories were: remembering, understanding, applying, analysing, evaluating and creating. Each level builds on the previous level as illustrated in Figure 2.1.

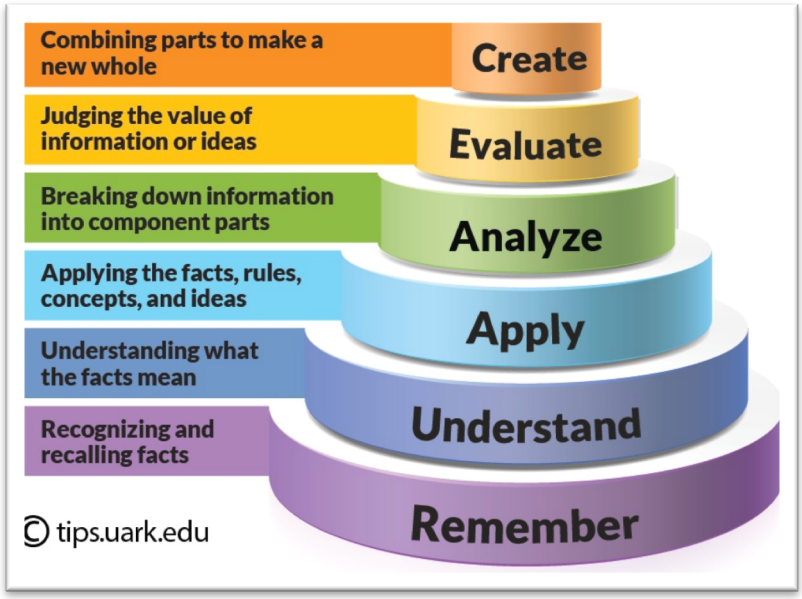


Figure 2.1: Revised Bloom's Taxonomies of Learning

Source: Shabatu (2018)

However, one gap that could be identified in this literature was that Bloom's taxonomies of learning were progressive and in an actual classroom situation, teaching may not necessarily start with lower-order skills. Moreover, learning can be fuzzy and might not follow strictly the six levels classification in a hierarchical manner. Since learning is dynamic, it is not always realistic to measure learning according to distinct levels or taxonomies. Therefore, this thesis helped in addressing this gap by analysing learning as it occurred, that is, when the learners were engaged in learning through the digitised learning resources.

Another viewpoint of cognitivism was that of Piaget (1896–1980) who introduced the idea that learners create knowledge rather than receive knowledge from the teacher (Austin, Orcutt, & Rosso, 2001). Piaget argued that students constructed knowledge based on their experiences and through several stages of their development Four stages of a child's development were proposed: the sensorimotor, pre-operational, concrete operational and formal operational. He argued that the human mind is set up in specific ways where knowledge is gained through life experiences. However, Piaget's research assumed that all individuals learn in the same way according to their ages but, with the technology invading

the lives of learners, the way children learn might no longer coincide with the stages of development that Piaget put forward. This study provided an in-depth analysis of learners' learning through digitised learning resources and hence tried to address this gap in the literature.

Cognitive theorists and behaviourists have different opinions about learning. On the one hand, behaviourists view learning as a change in behavioural dispositions of an organism and this can be shaped by selective reinforcement (Jonassen, 1991). Behaviourists such as Skinner equated learning with behavioural outcomes. They refused to acknowledge the 'existence of the mind' as this is not an observable behaviour. On the other hand, psychologists were more concerned with what learners know and how they acquire it. Cognitive theorists viewed the mind as an agent of learning. Therefore, in the modern era, learning was conceptualised through behaviourists' and cognitivists' perspectives. The change of behaviours of learners brought about cognitive development, and this was referred to as learning. However, most of these conceptions of learning did not account for the findings that learners show different sensitivities to working memory demands and none of these concepts of learning predict patterns of why learners are actually making such meaning out of what is being exposed to them. This is where the study attempted to find an explanation as to why learning is shaped in such ways.

Furthermore, during the late modern period, Dewey (1938), Piaget (1964) and Vygotsky (1978) defined learning as an 'active process' (Berkeley, 2018). They argued that learning is the process of engaging and manipulating experiences and conversations in order to build mental models of the world. They believed that learners build and acquire knowledge from their exploration of the world around them. The term 'constructivism' was used by Dewey (1938) among others to theorise learners' construction of knowledge by themselves (Hein, 1991). It was claimed that learners observe and interact, converse and engage with others to make connections between new ideas and prior understandings. He emphasised the engagement of learners in creating an understanding of the topic. Bruner (1971) also supported Dewey's (1938) arguments by seeing learning within the activity of the learner. His research emphasised the notion of

discovery learning where questions guiding the learning should be personally and socially relevant.

2.2.3.2 Postmodern era and learning

The postmodern era can be viewed as an extension to the modern world or an approach to educational change. 'In the postmodern era, the aim of education was to allow students to construct their own identities, and be responsible for their own knowledge, information and receive it at their own convenience.' (Bahmani & Mehar, 2014, p. 197). The focus was on experiential learning, active learning and student-centred learning. Therefore, education in the postmodern era revolved around 'experiencing, trying, and constructing knowledge' (Bahmani & Mehar, 2014, p. 197). The postmodern classroom provided opportunities for students to acquire knowledge from learning activities. The focus was on individual differences in learning rather than uniformity in thoughts and practice (Park, 2018). This is the era where research around learning styles started. Differences in students' learning styles were recognised and given special attention. Learning styles will be discussed in Section 2.3 of this chapter.

In the postmodern era, Burns (1995) included motivation to define learning. Learning was defined as 'a relatively permanent change in behaviour with behaviour including both observable activity and internal processes such as thinking, attitudes and emotions' (p. 99). The reinforcement theory of learning was improved by adding 'motivation' that leads to a desired outcome. It was argued that effective learning takes place by stimulating the visual sense in particular. Burns (1995) emphasised the fact that different features in the visuals like colours, volume, and animation create stimulation of multiple senses leading to greater learning (Dunn, 2002). The gap in this literature is that the research was mostly based on either animals or human adults. No in-depth research had been conducted on how children learn. This study sought to understand how children learn, paying attention to the variety of stimuli that would be contained in a classroom which is called a digitised classroom but which is still within a traditional set-up. The traditional classroom set-up favoured transmission-based teaching as in the premodern era. These dichotomies in the traditional classroom

set-up and the use of digital resources might have influenced the way the learners were learning. This is where this study actually provided an explanation of learning in the metamodern era where technology became an integral part of the teaching and learning process but within the traditional classroom situation.

Moreover, in their discussions of constructivist theory, Duffy and Cunningham (1996) also emphasised the role of the teacher in developing and presenting problems. They pointed out that the teacher plays a central role in mediating the teaching and learning process by designing appropriate instructions to arouse critical reflection and hence meaningful learning. This change in thinking could have influenced the learning process of people at that period as learning is intricately connected to people's ideologies. Individuals became more confident and were able to construct knowledge on their own and this belief was predominant in the postmodern era.

The main learning theories that were dominant in the late modern and postmodern era were constructivism and socio-constructivism. Constructivism emphasised the construction of new knowledge from students' previous experiences. Constructivists were of the opinion that human activity has a great impact on the construction of reality. 'Constructivists believed that learners are able to create knowledge according to their understanding of their experiences' (Driscoll, 2000, p. 376), which largely differ from behaviourists' and cognitivists' views of learning. Behaviourists and cognitivists do not actually view knowledge as internal to the learner. They argued that knowledge is acquired from external forces or sources and the learning process is the act of internalising it. However, constructivism contested this idea as it assumed that learners are not empty recipients where knowledge is to be filled. They argued that learners actively attempted to construct meaning out of the knowledge. Constructivists included lifelong learning in their discussions, as they believed that 'fuzziness' in classrooms helped to better prepare learners for lifelong learning (Siemens, 2004).

Constructivist principles acknowledge that real-life learning is messy and complex and constructivists claimed that learning does not happen in a vacuum

(Driver, 1989; Hart, 2018). They argued that learners often select and pursue their own learning. The learner needs to use sensory inputs to construct meaning, thus making it an active process (Driver, 1989). They argued that learning is meaningful and it is derived from an authentic context where learners are encouraged to pursue their individual goals (Confrey, 1990; Liu, Chen, & Hwang, 2018). In brief, shortcomings of behaviourism and cognitivism enabled constructivism to be explored further.

Constructivists explained that students create knowledge based on something presented to them and based on their interactions with the environment (Fosnot & Perry, 1996). In the postmodern era, Vygotsky (1978) expanded Dewey's viewpoint with the concept of 'Zone of Proximal Development' (ZPD), which he argued was the developmental level a child could reach with appropriate guidance (Schunk, 2012). Vygotsky (1978) emphasised social environment as being the facilitator or guide for development and learning (Schunk, 2012). Vygotsky included the social perspective of learning to constructivist theory and practice. He emphasised the fact that social and cultural interactions are critical for knowledge creation. He introduced the concept of the (ZPD) (Schunk, 2012). which is defined as 'the distance between the actual development level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers.' (Cherry, 2018 p. 1). Vygotsky used the term 'scaffolding' to explain the necessary guidance that a person with more advanced abilities provides to students to complete a new task or skill. He also posited that learning is socially constructed or co-constructed from peer interactions. Vygotsky's work focused on the roles of cultural and social factors in cognition and considered language as the most important means of learning (Essay UK, 2013). Vygotsky believed that learners learn through their engagement in the learning process.

In the same vein, Bruner (1967) viewed learning as an 'active social process'(Pritchard & Woolland, 2010, p 2). It was argued that learners construct new ideas and concepts based on the current or pre-existing knowledge (Pritchard & Woolland, 2010). Kant was 'another forerunner of social

constructivism' (Hacking, 1999 p. 41). It was argued that the knowledge that an individual acquires from the world is always subjective knowledge as it is filtered through human consciousness (Jackson et al., 2006). Kukla (2013) iterated this notion by arguing that reality is constructed by a social group; otherwise reality, dilemmas and critical reflection would not exist. Furthermore, Kilgore (2001) also celebrated the idea of social constructivism. He argued that knowledge is tentative, fragmented, multifaceted and not necessarily rational. He pointed out that knowledge is socially constructed and he believed that knowledge is contextual rather than waiting to be discovered. Lastly, Fosnot and Perry (1996) identified four epistemological assumptions of creating knowledge: (1) knowledge is physically constructed through active engagement of students in the learning; (2) knowledge is symbolically constructed by students through the learners' own internal representations; (3) knowledge is socially constructed by learners' experiences and (4) knowledge is theoretically constructed by students to try to explain things. However, Pritchard and Woollard (2010) contested the views of socio-constructivists pointing out that 'a social classroom can be a difficult place for pupils with some need' (p. 10). Pritchard and Woollard (2010) and Kelly (1963) argued that sometimes a social classroom provides more support than needed for children. In contrast, Vygotsky's arguments refuted the point that a social classroom is not meant for learners with special needs (Liu & Matthews, 2005). It was emphasised that the connection between the collective and the individual consciousness, is made possible through collective subjectivity. It was claimed that the external world is not fixed or has a super-structure but is given a shape historically by collective participation and collaboration (Liu & Matthews, 2005).

Table 2.2: Evolution of learning with technology

Year	Learning and Technology
Mid-1960s	Computers first appeared in schools. It allowed individualised drill and practice to reinforce basic skills (Robbat, 1996, p. 14)
Late 1970s	Micro-computers were developed- learning by experimentation (Papert 1980)
1980s	Introduction of application such as word processing, spreadsheets and distance learning via two-way audio and video (Tinio, 2003)
Mid-1980s	Innovative applications introduced with the use of interactive multimedia materials (Cartwright, 1999)
1990s	Multimedia Educational Software started to gain ground with the use of internet, World Wide Web as communication features to enrich curricula across the range of subjects. This powerful link with technology helped to address some of the problems in education (Mason, 2005)
2000s	Technology is universally embraced to transform how and what children learn in the classroom (Shields & Behrman, 2000)

Adapted from Popejoy (2006)

The notions of socio-constructivism continued to gain power with the integration of technology in classrooms. The social environment changed and the social interactions among learners were more prominent during the learning process. Table 2.2 illustrates the evolution of learning with technology. As shown in Table 2.2, in the late modern era, much importance was attributed to 'learning with technology'. The beliefs were that technology was the key to empowering learners to make their own representations of what they have learnt.

In the first decade of the 2000s, two approaches to technology use in schools were found (Jonassen, 2000; Jonassen, Carr, & Yueh, 1998; Jonassen,

Howland, Moore, & Marra, 2003; Reeves, 1998; Ringstaff & Kelley, 2002; Salomon, Perkins, & Globerson, 1991):

- Learning from technology; and
- Learning with technology.

Jonassen (2000) argued that 'learning from technology' is where the computer acts as the tutor. The computer is programmed to teach students and guide learning through activities with predetermined skills or knowledge (Popejoy, 2006). The term 'encode messages' was used to illustrate his views about how learning occurred. The views of Kulik and Kulik (1991) were somewhat resonant with Jonassen's arguments as it was argued that computers should be used in a tutorial capacity to help increase students' basic skills. However, the authors did not pay much attention to the basic skills that the students actually develop. They did not go into much detail about what and how the resources on the computer facilitate the learning of basic skills. Their studies were mainly restricted to what the computer can do. This is where the study addressed this gap and examined how learning occurred with regard to what the technology is offering.

Ringstaff and Kelley (2002) argued that 'learning with technology' occurred when the technology was merely a tool and it was the teacher and the students who actually mediated the curriculum and instructions. The emphasis was laid on the teacher and the students who controlled the learning and not the technology. Learning with technology started from mid-1960s and extends to the 21st century. Our learners are changing. How can a traditionalist approach to curriculum development or teaching engage and inspire students when life outside the classroom itself has changed so dramatically? While education systems have made great progress, the learners' experiences and attitudes have changed dramatically. Figure 2.2 explains the shift in education from traditional education systems to 21st-century learning.

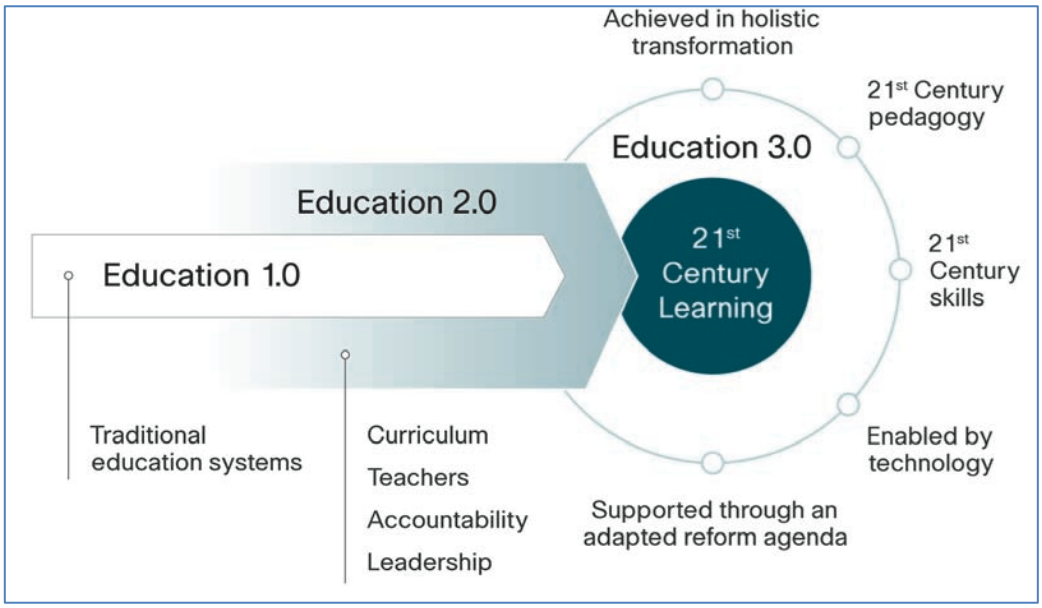


Figure 2.2: Education 3.0: A paradigm shift

Source: Computer Information System Company (2008, p. 7)

Education 1.0 represents education in the 20th century that is characterised by cognitivism, behaviourism, constructivism and socio-constructivism and limited performance management.

Education 2.0 represents systems reforms emphasising curriculum development and accountability.

Education 3.0 is the merging paradigm of 21st-century learning, focusing on equipping learners with new skills through the use of new pedagogies.

Jonassen (2000) added to the debate on 'learning with technology' saying that 'learning with computers supports knowledge construction, explorations, learning by doing, learning by conversing, and learning by reflecting as intellectual partners' (Popejoy, 2006, p. 15). Popejoy also called this approach 'cognitive tools' or 'mind tools'. According to Reeves (1998), when a cognitive tools approach is used, technologies are given to learners who then have the role of gathering, organising and analysing the information given. They normally use the information to solve problems. These cognitive tools are used to empower the learners to design their own representations of knowledge. They support deep

reflective thinking, mindful challenging learning and developing various skills. The cognitive tools also allow learners to offload mental tasks (for example, memorisation of data). In other words, cognitive tools act as a computer–intellectual partnership in the learning process and usually support inquiry-based projects.

Furthermore, Duffy and Cunningham (1996) made this point more strongly by considering learning and technology. The research of technology in the classroom was reviewed by highlighting the link between constructivism and technology. The relationship between constructivism and technology was explained through three different lenses: (a) technology as cognitive tools; (b) constructive view of the thinking process; and (c) the role of the teacher in technology-enhanced environments. By demystifying the constructs of modernism, postmodernists placed technology in the service of society to which one is committed to develop new intelligibilities (Gergen, 1990). However, the gap in the literature was that the research was mainly focused on the use of technology and its outcomes rather than how learners were learning through the technology. This study attempted to address this gap by offering an explanation on the process of learning through technology.

Moreover, in the previous century, the debate was mainly around grand theories: behaviourism vs cognitivism as explained above. However, current research assumes that 'learners in the 21st century are viewed as multi-taskers as sounds and images were used to convey content whenever possible' and they are always connected to the world (Rodgers et al. 2006, p. 1). Rodgers et al. (2006). They also noted that 'the content of a particular lesson is less important than manipulating content resources. Learning how to learn is the basis of education today' (Rodger, 2006, p. 3). However, the studies of Rodgers et al. (2006) were mainly focused on teaching in the 21st century and 'what' learners learn. Their findings did not give in-depth analysis of the 21st century learners' learning using technology. The study addressed that gap in the literature accessed by analysing 'how' learners learn using technology in the 21st century and the researcher felt it important to have a close look at the debates around learning theories that emerged in the postmodern era with the advent of technology in education and

its evolution. The next section presents a discussion on learning in postmodern era and its evolution in terms of theories of learning.

2.2.3.3 New waves of learning theories in the postmodern era

a. Connectivism

The discussion on the evolution of learning in the postmodern era is summarised in two different arguments that are usually combined: connectivism and enactivism. At the beginning of the 21st century, a new educational framework was developed and it was called 'connectivism'. Siemens (2004) pointed out that creating instructional environments referred to three general learning theories: behaviourism, cognitivism and constructivism. It was argued that there was a mismatch between the time these theories were developed and the context within which 21st century learners learn. It was emphasised that technology was not influencing learning during that period. It was argued that information development was slow at that time and that the 'life of knowledge' was measured as lifelong. González's (2004) views were resonant with those of Siemens on the life of knowledge. González explained 'the amount of knowledge in the world has doubled over the past 10 years' (Siemens, 2004). That change in knowledge was called as the 'half-life of knowledge' (Siemens, 2004). Siemens (2005) argued that the 21st-century learner is no longer restricted to only formal education. An attempt to explain the link between the learner and organisational learning was made by Siemens (2005). Learning was viewed as a continual process whereby technology helped in defining and shaping the learners' thinking. It was stated that 'know-how' and 'know-what' are augmented by 'know-where' (Siemens, 2004, p. 1.). A similar point was also made by Driscoll (2000) who viewed learning as a result of experiencing and interacting with the world. The arguments of different authors were all connected with the use of technology in the 21st century to facilitate teaching and learning (Weisz, Jain, Joshi, Johnson & Lange, 2019). Siemens (2005) explained the shift in learning theories in this digital era by including technology and connect making in learning activities.

In practice, connectivism offers an educator a mental representation of the learning process that cannot be observed or experienced directly (Dorin, Demmin

& Gabel, 1990). Even though the critiques of connectivism are still ongoing, connectivism has brought an important framework applicable to the use of technology in the classroom today. Siemens (2005) and Downes (2006) used connectivism to explain the learning process within a networked digital world. Ally (2007) also affirmed that learning is not totally controlled by learners as the environment is always dynamic with innovations and changes occurring in society. 'Connectivism is the integration of principles explored by chaos, network, and complexity and self-organization theories' (Siemens, 2005, p, 2). Siemens talked about the cycle of knowledge development where the flow was from personal to network and then to organisation. The learners have the opportunity to remain alert in the present field through connections they actually form.

Online learning brought considerable technological response to the different learning cultures, methods and inspirations (Duke, Harper & Johnston, 2013). The grand theories like behaviourism, cognitivism and constructivism have each contributed to developing online materials. Behaviourists focus on facts, which are important to understand concepts. Cognitivist strategies refer to the best way the process should be implemented. Constructivist strategies focus on real-life application, paying attention to meaning making. Unlike behaviourism, cognitivism and constructivism where the learners were expected to behave in specific ways according to conditioning, connectivism provides insight into learning skills and tasks needed for learners to flourish in a digital era' (Siemens, 2004, p. 6). However, the learning theory connectivism proposed by Siemens and Downes started a debate of whether connectivism is a learning theory or an instructional theory or merely a pedagogical theory (Duke, Harper & Johnston, 2013). Indeed, Connectivism may be used as both an instructional guide and learning theory to develop previous learning theories in a networked and digital world and not as a standalone learning theory (Ally, 2004). This study provides a clearer and deeper understanding of how far connectivism contributes to learning with technology among the young 21st century learners.

b. Enactivism

Another new philosophy of learning in the digital age is called 'enactivism'. During previous years, objectivism and constructivism also largely influenced the philosophical understanding of how learning occurs. On one hand, objectivists believed that learning should represent a societally accepted reality. Lakoff (1987) claimed that objectivism has its roots in realism and essentialism. Objectivists posited that the world is real and structured and its structure can be modelled for the learner (Jonassen, 1991). The epistemological view of objectivism was that the mind has purpose to 'mirror' reality and its structure (Jonassen, 1991). Objectivism attempted to explain that the learners are told about the world and are expected to replicate its content and structure in their thinking. They are not allowed to make their own representations.

On the other hand, constructivism came with a different view of the mind of the learner and learning. Constructivists claimed that an individual normally constructs knowledge based on one's previous experiences, mental structure and beliefs of objects and events. Unlike objectivism, which focuses on the 'object' of knowing, constructivism focuses on how an individual 'constructs' knowledge (Jonassen, 1991). Both perspectives gave a deep understanding of how to interpret learning and how to design an environment to support learning. However, both objectivism and constructivism were limited to how the individual 'mirrors' reality and its structure and constructs knowledge. Both perspectives did not consider how the learner acts with regard to the environment during activities. The research was not extended to the actual learning process within the classroom environment. To address this gap, a new philosophy of learning in the digital age called 'enactivism' emerged.

Beyond constructivism, enactivism has come to serve an umbrella for a wide diversity of views that may lend particular emphasis to the interaction of the learner and the environment. This theory is based on the ideas of Maturana and Varela (1987) and has been developed by Davis et al. (1996) who interpreted it within the context of mathematics education (Begg, 1999). Enactivism is defined as 'the view that cognition emerges in the interaction between an organism and

the environment, such that perception and action are co-constitutive of it' (Van Elk et al., 2010 p. 2). 'Enactivism implies that cognition is essentially tied to action and that cognition is always context-bound' (Van Elk et al., 2010 p. 2). 'Cognition should be understood in terms of the dynamical interaction between an organism and its environment' (Van Elk et al., 2010 p. 5). In other words, enactivism focuses on knowing rather than on knowledge as theorised by constructivism (Begg, 1999; Li, 2018). However, enactivism is somewhat resonant with radical constructivism, which focuses on the individual learner as a constructor, but radical constructivism did not consider the effects of human environment on learning.

Recent neuroscience research indicates that learning is a result of multi-sensory networks of neurons. Ideas such as right brain/left brain or unisensory are not supported by neuroscience according to the research of Goswami and Bryant (2007). They argued that children learn in the same way as adults, where the only difference is 'experience.' Children are still in the stage of developing skills to create their own thinking and learning (metacognition), thus regulating their own behaviour and interactions. Children have their own ways of constructing frameworks on what they are experiencing, for example why people behave in the ways they do. According to Goswami and Bryant (2007), the children already have a 'theory in mind'; they try to understand why objects and events follow certain patterns.

Furthermore, knowledge construction is an outcome of cumulative experiences of the young learner. Children's knowledge, reasoning and cognitive development are stronger when there are multiple representations of experience, for example, motor and visual representations (Goswami & Bryant, 2007). Goswami and Bryant (2007) also reinforced this link of experience with learning by stating that differential exposure leads learners' experiences to differential learning. For example, the extent to which children are exposed to reading texts inside or outside the classroom determines their reading fluency. Van Elk et al. (2010) have attempted to characterise this differential by representing their language comprehension and learners' experiences. They referred to the lack of experience as 'simulation constraint'. They argued that an embodied approach

to cognition could not totally account for the understandings of concepts or actions. Their focus of individual construction was on the actions that helped the cognitive processes in the learner.

In the same vein, Thompson (2007) and Werner (2018) viewed enactivism as the continuity between mind and life. They explained that meaningful learning takes place when individuals controlled and maintained their own identity with regard to their embodied actions. In other words, whatever someone does determines whether it is meaningful to that person and this is called learning. Enactivism is an extension of what previous cognitive researchers proposed as a metaphor: 'Mind As Brain' (Duffy & Cunningham, 1996). In fact, this metaphor was linked to the notion of 'connectivism' or 'parallel distributed processing' (Bala, 2018).

c. Enactivism and Connectivism

However, enactivism and connectivism are somewhat alike in that both characterise learning as being bound within individuals. However, a major difference is that connectivism sets a pattern of activation while enactivism views learning as the embodied action within the environment. Enactivism philosophy aligns with meaningful learning and action learning within a space. This difference sets the stage for the possibility of researching the teaching and learning process in a classroom environment that is completely different from a traditional classroom. This study attempted to give a fresh reflection of embodied action of 21st-century learners within a digitised classroom environment.

2.3 Children's learning and development

Children's learning is a complex phenomenon, and discussing the various ways children move between stages during their learning helped the researcher to analyse children's learning through the digitised learning resources. In this section, the middle or mini theories are considered and they are based on work of Erikson (1968), Montessori (1967) and Egan (1997, 2001). There are indeed many theories explaining children's learning but the researcher decided to refer to only the work of these three theorists as they provided good insights into learning among learners of eight to nine years old. The work of other theorists

were mostly focused on learning among kindergarten learners. Moreover, Erikson's (1968), Montessori's (1967) and Egan's (1997, 2001) theories are seminal work on children's learning.

Erikson (1968) was well known for his work on psychosocial theory (Sokol, 2009). It was argued that 'identity' was built at a very young age where the child was identified as unique As the child grows, relevant features of his parents are taken but later the child eventually starts the process of identity formation (Sokol, 2009). The 'sense of identity' has always been given great importance as it is believed that identity has a close link to child development and learning (David, 2014). During the postmodern era, Erikson (1968) developed a theory on how people develop a 'sense of identity'. It was claimed that there are three aspects of identity: the ego, personal identity and the social/cultural identity (David, 2014). He argued that identity formation starts from childhood and helps 'to give a continuity with the past and direction for the future' (Marcia & Kroger, 1993, p. 103). Erikson (1968) proposed that personality development occurs in eight stages of psychosocial development in a pre-arranged order (McLeod, 2018). It was argued that the psychosocial crisis that a person experiences during his life at different stages might affect the person's personality development positively or negatively. For example, experiencing bullying at school may influence a child's personality development. The main gap in the literature is that personality development is not always fixed as individuals rediscover themselves at several stages.

Furthermore, Erikson (1968) argued that the child's social interaction and experience are not developed out of sexual interest as claimed by Freud. It was argued that the socio-cultural factors are very important in identity formation and that the childhood identifications affect identity formation in adolescence (Marcia & Kroger, 1993, p. 103). Erikson (1968) referred to this process as the 'process of identification'. Since identity formation and learning are closely linked, the researcher deemed it worth considering Erikson's (1968) theories to probe deeper into analysing learning through digitised resources. However, Erikson (1968) did not provide a lengthy discussion on identity development during childhood (Sokol, 2009). The findings were mainly focused on identity formation

in adolescence. This study tried to address this gap in the literature by analysing learners of eight to nine years old learning with digitised learning resources. This eventually provided additional insights about how far Erikson's (1968) claims about identity formation and socio-cultural factors were sustained or not when the learners were interacting with the digitised learning resources. Moreover, this study also contributed to the body of knowledge in terms of learning and identity formation.

A second perspective of viewing child learning is by discussing Maria Montessori's (1967) method of education, which revolves around 'self-directed activity, hands-on learning and collaborative play' (Cossentino, 2006). Montessori's (1967) work has marked the philosophy of teaching and learning in kindergarten. Nevertheless, the work was extended to learners of different age groups. The researcher opted to use Montessori's (1967) work as the research was focused on the mind of the child ranging from early childhood learners to learners of six to 12 years old (Maunz, 2018). In the case of this study. The researcher focused only on Montessori's (1967) views on learning of the six- to 12-year-old child as the age group of the participants in the research was eight to nine years old. Montessori (1967) proposed that for learning to happen, children need to make creative choices and choice of appropriate activities should guide the learning process (Maunz, 2018). Montessori (1967), argued that the child of six years old starts to become less passive and more receptive. It was pointed out the mind of the child of six years old no longer absorbs knowledge but engages in reasoning and hence creating stability and growth without much alteration (Maunz, 2018). Montessori (1967) referred to this as 'conscious' learning being very interesting and important for the child. The child aged six to 12 years can use his or her own constructive reasoning skills to make decisions (Maunz, 2018).

Montessori (1967) also posited that grown-up children become stronger when they associate themselves with their own group of peers (Maunz, 2018). Montessori (1967) provided an affirmation by showing children working in groups in class. Montessori's (1967) views were somewhat resonant with Vygotsky's (1978) views of learning as they both gave much importance to socio-cultural

factors for learning to happen. While both Montessori (1967) and Vygotsky (1978) believed that instruction is crucial for child development, their arguments also differed in many ways. Both Montessori's (1967) and Vygotsky's (1978) approaches can be described as constructivist. However, Montessori (1967) argued that the child of six years old constructs knowledge out of his or her own natural interest in learning which means that if children are left to follow their instinct, they will be prompted to constantly explore the world. It was argued that if the environment is properly constructed, children are able to learn through their own natural interest. In contrast, Vygotsky (1978) argued that there is nothing natural or biological at work, and the child constructs knowledge through interactions with the social context. Vygotsky (1978) believed that the child's nature and mental functions are shaped in a shared cultural space (Bodrova, 2003).

While Montessori viewed learning as discovery based on the child's readiness and interest, Vygotsky (1978) viewed learning as assisted discovery with formal instructions from the teacher (Bodrova, 2003). In this study, the participants were learning through the digitised learning resources in a traditionally styled classroom where the environment was not shaped in a specific way to promote a child's interest and learning through social interactions. The learning could be discovery as claimed by Montessori or assisted discovery as believed by Vygotsky (1978) or it could even be an oscillation between Montessori's and Vygotsky's (1978) views of learning.

Furthermore, learning can also be aided using cognitive tools. Taking back Vygotsky's (1978) arguments on learning, Egan (1997) referred to cognitive tools as tools that accompany the individual during his or her growth in the society. It was argued that there are five classes of understanding or cognitive tools that individuals master during their development that reflect psychological, epistemological and cultural factors. The first four cognitive tools were proposed as Somatic, Mythic, Romantic and Philosophical and the fifth as Ironic understanding. Each cognitive tool or understanding occurs at a specific age or stage in the individual's development. Since this thesis focused on children of eight to nine years old, the Romantic kind of understanding or cognitive tool was

given attention. The core characteristics of the Romantic kind of understanding include mastery of writing and literacy as well as acquiring finer skills in perception and thinking (David, 2015).

For instance, these cognitive tools can be use of stories, fantasy or metaphor formation (Egan, 2001). Warnock (1976) argued that when words are converted into images, emotions are involved. It was believed that generating own images from texts may actually improve the richness of learning (Egan, 2001).

Gardner et al. (1978), argued that the pre-school learners had greater ability to complete a metaphor in a sentence than older children (Egan, 2001). Early childhood learners have the readiness to complete a metaphor as this forms part of their interest and environment. Gardner et al.'s views corresponded with Montessori's views that the child's interest is vital for learning to happen and with Vygotsky's (1978) views of the learner having the need to be accepted by peers or in society. In this study, Montessori's and Gardner's views of learning were analysed against learners of a higher age group (eight to nine years old) and in a context where the use of technology was embraced.

With cognitive tools theory, children's imagination is catered for and the learners become more creative and concrete thinkers (Egan, 2001). The learners are able to develop several competencies like producing metaphors rather than just consuming them. In the 21st century, cognitive tools often refer to computers being used as tools that aid learning. In this study, learners' interactions through digitised resources were explored in a view of determining whether the learners actually became creative and concrete thinkers.

2.4 Learning and learning style models

In the above discussion, it was argued that learning emanated from the interactions of the learners inside or outside the classroom. However, there is more to conceptualisations of learning than just interactions among learners. This section discusses various learning styles. The researcher deemed it important to debate learning styles as they help in understanding why learners learn in the

ways they do when they learn through digitised learning resources. Hence, learning style was used as a conduit to understand learners' learning.

Learning styles are ways learners enact their learning according to their individual differences or preferences. Keefe's (1979) definition of learning styles took into consideration the three domains of learning: that is cognitive, affective and physiological. It was argued that these domains serve as 'stable indicators of how a learner perceives, interacts with, and responds to the learning environment' (Keefe & Ferrell, 1990, p. 57). The concept of learning styles was based on six premises that were shared by 20th-century scholars who researched theories of human learning and development, notably John Dewey, Kurt Lewin, Jean Piaget, Williams James, Carl Jung, Paulo Freire, Carl Rogers and others (Kolb, 2005, p. 195). They argued that 'learning is best conceived as a process and not outcomes' (Kolb, 2005, p. 195). They also advanced that 'all learning is relearning' which requires 'the resolution of conflicts between dialectically opposed modes of adaptation to the world' (Kolb, 2005, p. 195). They also pointed out that 'learning is a holistic process of adaptation to the world' and 'it results from synergetic transactions between the person and the environment' (Kolb, 2005, p. 195.). Lastly, they viewed learning as 'the process of creating knowledge'.

Many studies have shown the existence and significance of individual differences through aptitude treatment interactions (Ayersman & Minden, 1995). 'Students have different learning styles – characteristics, strengths, and preferences in the ways they take and process information' (Felder, 1996, p. 1). The learning styles of each learner actually help them to recreate the information in specific ways. This section focuses on learning styles and models of learning styles that helped in providing a lens to analyse learning through the digitised learning resources. There are several models of learning styles but for the purposes of this thesis, only well-known models were considered to foreground the discussion around learning and learning styles. These models were chosen as they present rich interpretations of learning styles within context and they corroborate with this investigation of learning through digitised resources within a specific context and era.

2.4.1 Howard Gardner's multiple intelligences

One of the pioneers of learning styles was Howard Gardner who explored multiple intelligences (Gardener, 1992). A list of seven intelligences was formulated, namely linguistic, logico-mathematical, musical, bodily kinaesthetic, spatial, interpersonal and intrapersonal (Gardner, 1999, pp. 41-43). Howard Gardner (1999) claimed that the seven intelligences rarely operate independently and that they are used at the same time. It was argued that they tend to complement each other as people develop skills or solve problems (Smith, 2002). It was also stated that 'people have a unique blend of intelligences and the challenge facing the deployment of human resources is how best to take advantage of the uniqueness conferred on us as a species exhibiting several intelligences' (Gardner 1999, p. 45). His work had a profound impact on thinking and practice in education. Gardner's (2006) argument for an eighth intelligence, known as naturalist intelligence, emerged in 2006 and was characterised by an inherit ability to 'recognize instances as members of a species' (Gardner, 2006, p. 19). In 2009, Gardner considered a ninth intelligence called the existential intelligence, which describes one's ability to conceptualise or take on the deeper, large questions about human existence (Christodoulou, 2009). Thus, according to Gardner, learning is facilitated by the close correspondence of the learner's internal representation of the information and the mode of the representation. Figure 2.3 shows the different learning styles proposed by Howard Gardner (1999) through multiple intelligences.

Figure 2.3: Howard Gardner's multiple intelligences

Source: https://greycaps.com/theteacher/Community/Multipleintelligence)

Despite the fact that Gardner's theory became very famous among educators, many criticisms were made of the theory of multiple intelligences. Aiken (1997) refuted Gardner's ideas of multiple intelligences by arguing that his ideas were based on reasoning and intuition and there was no empirical evidence (Aiken, 1997, p. 196). Another critique is about how to measure learning styles. Honey and Mumford (1992) argued that research on learning styles explained the preferred ways learners learn but did not report on how best to measure these learning styles. The link made between the mind and education has helped us to understand how learners preferred to learn but because of the limitations of empirical evidence, these statements could not be generalised to different classroom contexts. The study helped in addressing this gap as data on learners' learning were collected in real classroom situations where learners were actually learning concepts through the digitised learning resources. The findings of the study were credible and trustworthy as there was empirical evidence to support the claims.

Another criticism of Gardner's (1983) theory of multiple intelligences was that it was not defined precisely whether the intelligences were referring to 'abilities', 'skills' or 'aptitudes'. Stenberg (1985) asked whether a person with physical difficulties could be considered in the same terms as a person without disabilities when looking at his or her learning styles. Stenberg's (1985) arguments were that different cultures have different views of the multiple intelligences. For example, the intelligence 'bodily kinaesthetic' might be more valued in certain cultures where hunting was the activity for survival.

Gardner (1983) claimed that 'intelligences' are modules. It was argued that modules helped to create particular contents and that each module conducts operations independently. In brief, Gardner's Multiple Intelligence Theory implied that the mind is made up of seven or eight mechanisms where each one works separately. However, Gardner (1983) failed to explore whether the different modules can work interchangeably or concurrently. For example, 'conversation can be both linguistic and interpersonal' (Klein, 1997 p. 379). In this study, learners' learning through the digitised learning resources brought a conceptual contribution as to how the interactions in the digitised classroom provoked the learner to learn.

Coffield (2013) also refuted the ideas of multiple intelligences proposed by Gardner (1983) as it was argued that the particular context that the students were learning was not taken into consideration. It was posited that the context might have a large influence on the preferred way the learners learn (Coffield, 2013). It was argued that the context in which the learner is learning leads to promotion of specific skills and that learning style is dependent on the subject or problem (Coffield, 2013). An example of learning to become a hairdresser requires different skills than learning to become a plumber was given (Coffield, 2013). However, Coffield did not consider technology while researching the context. Coeffield's research was focused on the skills that the learner had to acquire and whether the environment was conducive enough for the learners to acquire those skills. This study helped in addressing this gap by analysing how leaners were learning in the metamodern era where technology invades the lives of the children but the classrooms were still in the traditional configuration.

2.4.2 Kolb learning style model

Another model that frames the learning of students is the Kolb learning style model. Kolb did many years of research involving scholars around the world (Kolb, 2007) and obtained data from thousands of respondents. The research culminated into the Kolb learning style model (Kolb & Kolb. 2005). The Kolb learning style model classifies students as having different preferences: (1) concrete experience or abstract conceptualisation (how they take information in); and (2) active experimentation or reflective observation (how they internalise information) (Kolb & Kolb. 2005). This classification identified four types of learners. The first type of learner, the concrete-reflective, shows good response to the explanations of how the lessons relate to their interests, experiences and future careers. The role of the teacher is the 'motivator' to arouse the interests of learners and allow them to respond in relation to their experiences and future endeavours. The second type of learner, the abstract-reflective, responds to information organised in a logical manner that allows them to reflect. Here the teacher should act as an 'expert.' The third type of learner, the abstract-active, responds to information actively on well-defined tasks, learning through trial and error. The teacher functions as a 'coach' or 'facilitator' that guides learning through feedback. The fourth type of learner, the concrete-active, uses information to solve real problems. The learner learns through discovery. The teacher should provide opportunities for discovery learning to happen. Figure 2.4 illustrates different learning styles that Kolb put forward from his research. The Figure 2.4 was adopted from Ruspat (2010).

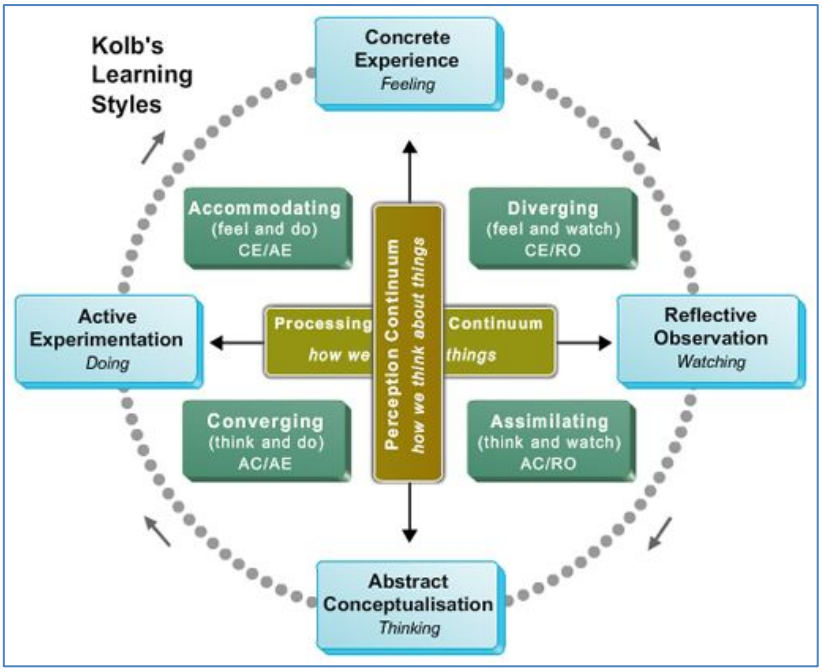


Figure 2.4: Four Distinct Learning Styles according to Kolb's Learning Styles

Source: Ruspat (2010)

Kolb and Kolb (2005, p.1) noted, 'learning is best conceived as a process, not in terms of outcomes'. They stressed that engaging learners in the process enhanced their learning. They emphasised learning as a process including feedback on the effectiveness of their learning efforts. The views of Kolb and Kolb (2005) were somewhat resonant with O'Toole's (2008) views of the need to put the learner at the centre of the learning process. Added emphasis began to be placed on the needs of the learners and not on educational objectives. O'Toole (2008) proposed that learners ultimately produce learning. The term 'learning power' was used to illustrate a kit of learning skills that was developed. The kit consisted of: (1) how one pays attention; (2) how one feels; (3) one's personal qualities of hope and curiosity; (4) the capacity to reflect; (5) how one senses; and (6) the ability to communicate and work in groups. It was suggested that involving emotions, physical awareness and intellect are important part of the children's learning process.

Even though the Kolb theory is extensively acknowledged in the field of education and recognised for its use to improve performances, the problem with Kolb's theory is that it did not consider different real situations (Greenaway, 2007). The

neat learning stages proposed by Kolb may not always be a reflection of people's reality. In practice, processes can occur at once, jumped, or even missed completely (Forrest, 2004). Similarly, Jeffs and Smith (1999) also agreed that learning does not always occur in a linear way. Jeffs and Smith (1999) believed learning might happen simultaneously during learning. Since learning is dynamic, it cannot be neatly structured as in the model proposed by Kolb (1984). This study addressed this gap by researching on how learning occurred in a digital classroom and why learners learned in such ways. This helped in contributing to the body of knowledge on whether learning is actually neatly structured or fuzzy when using digitised learning resources.

However, Boud et al. (1985) had a different view of the Kolb Learning Cycle (Smith, 2001). They argued that the type of learner and the type of activities they are engaged in might alter the stages of the Kolb model in various ways. Moreover, in the modern era, Dewey (1938) discussed the complexity of reflective learning processes and for instance, Smith (2001) also argued, it is too simple and problematic to represent the complex reflective processes of learning through neat and structured stages. Furthermore, Smith (2001) also advanced that at that moment digital tools were not there to support or facilitate learning. The Kolb learning model belonged to the postmodern era where the use of digital tools was not widely recognised and there is an important need to research the processes of learning in a metamodern era, rich in digital media. Since the study looked into learning with digitised resources, the gap involved in learning with digital tools was actually catered for.

Adding to this debate, Greenaway (2007) argued that Kolb's theory was confined to limited factors that could influence learning. The social, psychodynamic and other institutional attributes to learning were not considered. Greenaway (2007) posited that the learning style or learning type of people changes over time and situations and these changes might require different approaches for the same person at different stages of life. Furthermore, Forrest (2004) also argued that the Kolb Learning Cycle failed to make allowance for ways of learning other than experiential learning and the latter might not be applied to varied situations. Forrest (2004) argued that the inventory that Kolb (1984) used in his research

was limited to a range of Western cultures and was not generalised to other cultures. Similarly, Dickson and Tugwell (2000) also argued that the Kolb's (1984) research lacked consideration for people from varied backgrounds, cultures, gender, ages, socio-economic situations and education. The study tried to address this gap by looking at learning through digitised learning resources where the culture was not of Western one but a multi-racial one in a developing country, Mauritius. This helped in informing other modes of learning in different cultures and in an era where technology has become part of the culture.

Learning styles have been applied and accepted to explain the learning process. However, there is still some debate about the validity of the concepts (Husmann & O'Loughlin, 2019). The different conceptions of learning styles maintain that the classroom teaching methods are directly proportional to the students' preferred learning styles. Many teachers believe that learning style is one of the factors that contributes to the effectiveness of students' learning but this might not always be the case. Although the Gardner's (1978) model and Kolb Learning Cycle are popular for their simplicity, however, it is more noteworthy to consider how the results are used rather than categorising as 'label'. The study sought to address this gap by trying to bring an understanding of how learners with different learning styles learnt the concepts presented through digitised learning resources.

2.5 Conclusion

This chapter has highlighted the different conceptualisations of learning over time. What is noteworthy is that some conceptualisations have been carried over to subsequent eras. Furthermore, some conceptualisations of learning have developed in stark contrast with previous ones. Cognitivism could be cited as an example in this case. Indeed, cognitivism believes in the internal working of the human brain, while for behaviourists, the human brain is deemed unattainable. There are several notions of both behaviourism and cognitivism in constructivism. Feedback, which could be considered as a behavioural concept, is an essential element of constructivism. The notion of scaffolding could be influenced by cognitive markers; these markers help learners to understand information and

possibly move up to another level of knowledge. Even connectivism is sometimes considered an extension of socio-constructivism. Moreover, radical constructivism resonates to some extent with enactivism.

What can be noticed is that newer conceptualisations of learning tend to borrow to some extent from older ones. Moreover, newer conceptualisations also appeared at times when there were social changes on a massive scale. Indeed, behaviourism emerged in times when mass schooling appeared in the modern era. Cognitivism developed in the computer age, building human cognition on the computer metaphor. More interactive forms of technology coincided with the rise of socio-cultural explanations of learning. The question that arises is what could be the newest conceptualisation of learning in an era where technology is in classrooms in a form that was unconceivable only decades ago. Indeed, it would have been difficult to foresee in the 1950s or 1960s that classroom walls would become interactive and teachers and learners would be able to engage with these walls (as in the case of the digital classroom set-up).

Therefore, an appropriate theoretical lens is needed to better understand the zeitgeist of this so-called digital era. This theoretical lens needs to adequately capture how this era makes sense of social phenomena; learners' learning being the phenomenon under the research lens of the study. This sense making could be along the lines described above; a carrying over of some concepts from previous conceptualisations of learning to generate a new one with the addition of new elements. On the other hand, it could be something new altogether, breaking away from previous concepts. Digital technologies such as the IWB may be a game changer in the classroom. However, radical change has not occurred in the classroom (as mentioned in Chapter 1). The same four walls, furniture, methodologies, content and modes of interaction probably cohabit with digital technologies. One of the gaps that this study sought to address was: 'What is the new conceptualisation of learners' learning in a context where the old and the new co-exist?'

Hence, the researcher believes metamodernism is an appropriate lens to look into learners' learning with technology. Metamodernism is a theory that contends

that the world is in a post-postmodern era, beyond postmodernity. This theory explains a mode of thinking and philosophy that transcends postmodern thought. Therefore, the author believes it could aptly capture the mix of old and new and the brew it could result into. The next chapter will give a detailed explanation of metamodernism and theoretical understandings of education from modern and postmodern perspectives.

Chapter 3: - Theoretical Framework

3.1 Introduction

The previous chapter discussed the literature on learners' learning. An exploration of learning through different elaborations provided an introduction into the terrain of learning. Then, a historical perspective on learners' learning was adopted, charting the phenomenon from the pre-industrial to the postmodern era. Several theories of learning, such as behaviourism, cognitivism and constructivism were considered. The literature also moved the discussion beyond constructivism to purposely step into the digital era. Indeed, the focus of the study is learners' learning with digitised learning resources. Therefore, novel perspectives of learning such as connectivism and enactivism were considered. From this approach, the researcher could identify the gaps in the literature. One of the first gaps is that no theory could satisfactorily explain young leaners' learning through digitised learning resources within the classroom. The second gap was that the explanations of learning that were examined in Chapter 2 did not specifically pay attention to the hybrid nature of the 21st-century classroom (in the Mauritian context of the study). Furthermore, the complexities of learning were explained through an account of diverse learning styles. These explanations were supported by two famous learning styles models that provided different ways to view learners and their preferred learning styles. The gaps in the literature with regard to the models explored were also indicated.

This chapter describes the theoretical framework of the study. From the introductory chapter, one can note the hybrid nature of Mauritian classrooms. Indeed, the classrooms in the study are a mix of traditional and modern set-ups. The traditional set-up of tables, chairs and walls are combined with hi-tech equipment such as IPs and laptops. Also important was the amalgamation of tasks that teacher educators, teachers and learners were asked to perform in this peculiar hybrid set-up; mixing up traditional and technological learning strategies. Therefore, the researcher believes that a new frame of reference is needed to examine learners' learning through digitised learning resources in the hybrid situation of traditional set-up where technological learning tools are introduced

into the traditional framework. This need has been explained in the previous chapters and is beyond traditionalism and techno-centric approaches to learning (that are expressed to some extent by connectivism in particular). Hence, an approach that breaks away from both traditionalism and technocentrism is metamodernism. Metamodernism will be explained in detail in this chapter.

3.2 Purpose of this chapter

Before going deeper into metamodernism, the purpose of this chapter must be explained. This chapter was the intellectual structure that guided the study. Indeed, theoretical frameworks in educational research inform the research design, data collection, and analysis (Troudi, 2010). This chapter reflects the lens used to analyse learning through digitised resources. For doctoral studies in particular, theoretical frameworks enable theory-driven thinking (Grant & Osanloo, 2014). The theoretical framework is used as a structure supporting a theory of a research study (Gabriel, 2013). This was very important, as one of the objectives of the study was to move boundaries in the understanding of learners' learning with digitised learning resources.

The researcher used the metaphor of a 'blueprint' of a house to explain the theoretical framework. Without a 'blueprint', it is difficult for one to construct a house. In the same way, one could not look at the data, analyse it and draw conclusions without the lens of theory. A study may be unclear without a theoretical framework. Furthermore, a theoretical framework reflects the personal beliefs and perspectives on the nature of knowledge of the researcher (Lysaght, 2011). In this study the most advanced technology exists side-by-side with a century-old institution; all of what the classroom entails as teaching and learning practices. Suddenly, in this digital era, technology has become another player in this old and well-established institution. This mix of old and new might be aptly captured through the lenses of metamodernism.

In the process of finding an appropriate lens to analyse the phenomenon of the study, namely learning through digitised resources, the researcher started focusing on the work of Vermeulen and Van den Akker (2010) who researched the foibles of modernity and postmodernity and are widely recognised as most

influential thinkers around metamodernism. Therefore, the theoretical framework is based on the theory of metamodernism, which is in line with the context in which the study was carried out. The frame of reference and identification of the metamodern era are presented through the concepts of modernism, and postmodernism and the framework of the 21st century. One characteristic of modern times is that the concepts pertaining to late modernism and postmodernism have exceeded the historical boundaries of their creation, which appeared in the 18th and 19th centuries. Instead of eras, they now appear as culture, ethos, and a way of life and thinking formulated by the Enlightenment view of physical activity (Koutselini, 1997). In this era, there is a co-existence of different ways of life and thinking which results in a dialectic relationship (Koutselini, 1997). Moreover, Foucault (1982) and Lyotard (1984), argued that the shift in the way we perceive 'being in the world' is another essential characteristic of contemporary social inquiry and it is positioned in terms of a crisis in legitimation of knowledge and of the traditional identification of human relation to the world.

Theoretical frameworks also give a signal as to what data is to be collected; the research design, analysis and interpretation (Anfara & Mertz, 2006). In this study, the researcher used metamodernism as a lens to the data that were generated, the research design and for analysis of the young learners' learning through digitised learning resources. Metamodernism is explained in detail in the next section. However, at this point the researcher can shed some light on what metamodernism is. With the idea or feeling of 'an end of postmodernism', Vermeulen and Van den Akker (2010) tried to define a new cultural branch and they called it 'metamodernism'. The literary debate on metamodernism discusses more about the concept rather than the question of the existence of post-postmodernism. This study revived this debate by analysing learning through digitised resources in a post-postmodern era. Metamodernism could be a 'structure of feeling' (Williams, 2015). This means that metamodernism reflects a type of social experience different from social experiences of other eras.

With the advent of the internet, opportunities have been created for individuals to quickly and easily browse for information they are interested in and unite with

other people around the globe for the realisation of projects. According to Vermeulen and Van den Akker (2010) ‘self-actualisation’ through the action in a metamodern era is linked with the presentation of sincerity when irony is the ‘default mode’ (Syundyukov, 2017) as a result of the cultural form. It consequently became both sincerity and irony. Sometimes, ‘deliberate self-deception’ (Eshelman, 2000) allowed sincerity with lots of energy and enthusiasm when in fact the person is not what one is actually pretending to be.

Creativity is another concept that accompanies ‘self-actualisation’ and it is always about self-determination. Therefore, in this metamodern era, people tend to rely on their own individual spiritual continuum and identity to create knowledge (Grebenyuk & Nosovtsov, 2017) and this served as a lens for me to analyse the learning process within a digital classroom. The researcher asked several questions to better understand the learning process. Some were whether learning through digital resources brought ‘self-actualisation’ in the learners as suggested by Vermeulen and Van den Akker (2010) and also why learners learn the way they do in this era where creativity is largely manifested. In the study, learning was analysed with regard to concepts of metamodernism but at the same time taking into consideration late modernist and postmodernist practices, which still dominate in the Mauritian classroom environment and the choice of teaching strategies.

With the dawn of the era of metamodernism, more and more people started to realise that what they had already learnt had become insufficient to comprehend reality. This realisation triggered change in the mode of work and the culture, thus prompting a choice between sincerity and irony (Vermeulen & Van Den Akker, 2010, 2015). As a result, the teacher in the digitised classroom has to adopt ‘a new ideological position that emerged while oscillating from the modernist attitude to the postmodernist attitude and back’ (Grebenyuk & Nosovtsov, 2017, p. 3). The study tried to explain how the learners were learning in the digitised classroom where oscillation predominates and why they learnt in such ways.

Postmodernism and modernism included a number of diametrically opposed first principles (Johnson, 2017). For instance, in postmodernism emphasis was on the

researcher's attention to historical events rather than universal properties and qualities, which explains that sincerity was there but irony was also in the background. Hence, the subject of research began to disappear leaving space for social processes that 'began to pace its multiplicity' (Grebenyuk & Nosovtsov, 2017, p. 3). However, metamodernism sees both modernism and postmodernism operating simultaneously within a single individual or group of individuals (Abramson, 2015). In other words, metamodernism is viewed as a negotiation between modernism and postmodernism. In fact, metamodernism is not a rejection of postmodern and modern concepts but it is rather a progression from them. Toth (2010) qualified metamodernism as a mash-up of residuals from precedent eras such as modernity and postmodernity. He believed that residuals or ghosts from other eras still haunt metamodernity. Modernity has passed on a legacy to postmodernity and postmodernity has passed on another legacy to metamodernity.

However, Vermeulen and Van den Akker (2010) contended that metamodernism is beyond Toth's (2010) conceptualisations. For logic prevailing in the early 21st century, this cultural logic could possibly be a means to break away from postmodernism. This cultural logic could also be a response to the crises faced by humanity in the 21st century. It would be logical to ask at this point, where the crisis in education is. It could possibly lie in issues related to learning with technologies in the classroom. Indeed technologies have promised a lot. Papert (1990) envisioned that computers would revolutionise learning as discussed in Chapter 1. Have technologies delivered Papert's vision? It would be fair to say that the promise has not materialised fully. Governments, as in the Mauritian context, have invested heavily on educational technologies, but have they really revolutionised learning? However, the researcher's instinct was that to materialise Papert's vision, a move away from techno-centric concerns was needed (such as 'will computer increase learners' creativity?'), and focus on more pedagogical concerns was necessary. The need to understand what learners learn through digital technologies in the traditional classroom situation and why they are learning in such ways was given attention in the study. The main research questions are re-iterated to actually make the point why analysing

learning through digitised learning resources from the lens of metamodernism helped to bring new dimensions to learning in an era where oscillations from modernism to postmodernism manifested.

The study revolved around these main research questions:

- What do learners learn through digitised learning resources in Mauritian primary schools?
- How do learners learn through digitised learning resources in Mauritian primary schools?
- Why do learners learn the way they do through digitised learning resources in Mauritian primary schools?

Coming back to metamodernism, it could be said that it is an era of great oscillations (Vermeulen & Van den Akker, 2010). Indeed it is an era that has carried on with modernity's need for sense and postmodernity's craving for doubt. Metamodernism could be disorienting. It could hold in modernity's sincerity as well as postmodern irony. There could be other dualities that co-exist in the metamodern era (such as corruption and honesty, empathy and apathy). In the case of this study, the oscillation occurred in the classroom environment where learners' learning possibly shifted to and from traditional methods to digital technologies. How did this era come about? The next section explains the shift from postmodernism to post-postmodernism, and metamodernism.

3.3 Modernism and postmodernism

The previous section provided a broad overview of what metamodernism is. This overview enabled the researcher to re-emphasise the research questions and to some extent gave indications as to how it is intended to answer them. However, to fully grasp the metamodernism framework, the researcher felt it was essential to understand how it evolved from postmodernism. The next sub-sections also deal with postmodernism and its relevance to education and learning as a subset of the latter. Indeed, it was useful to locate learners' learning and related concepts within these socio-historical eras to better understand the oscillation occurring in the Mauritian classroom.

3.3.1 Postmodernism

According to Hicks (2004), postmodernism could probably be a new intellectual age. For some authors such as Lyotard (1990), postmodernism arose from the disappointment with modernism and its grand narratives of progress and peace. Therefore, a review of modernism was needed to fully grasp postmodernism. Modernism, through the Enlightenment, produced 'reason'. 'Reason' can be interpreted as the human ability to know about the world (Bacon, 1640; Locke, 1690). Reason, when applied to people, produced individualism. Humans could decide for themselves. The product of reason and individualism were democratic political systems. Similarly, reason and individualism also produced an economic system: liberal capitalism.

Applying reasoning to science produced engineering and medicine (Hicks, 2004). Indeed, the Enlightenment produced scholars such as Newton and inventors such as Watts. The Industrial Revolution was also made possible through numerous inventions that could probably be a result of technological progress. Reason applied to science also developed into medicine. Therefore, humankind could achieve both material comfort and freedom from disease and ailments. There was a feeling that modernity had also made us attain wealth and freedom through the democratic and capitalist systems. From the above, authors such as Lyon (1999) outline the 'gains' from the Enlightenment period as differentiation through division of labour; rationalisation of systems such as governments and production sites where everything could be counted and measured; mass movement of population from rural to urban areas (urbanism); discipline through legal and bureaucratic systems and secularity as beliefs in the supernatural declined.

However, even these outcomes of modernity such as progress and freedom are presented as 'gains', pathologies tell another story. In the postmodern era, the concepts of modernism were no longer tenable (Preda, 2001). Delanty (2000) and Lemert (1997), saw postmodernity as perhaps the last stage of modernity. The so-called 'gains' of modernism exhibited strange pathologies (Lyon, 1999). Economic progress had degenerated into alienation of workers and their exploitation on a global scale. Urbanism, secularism and rationalisation of social

institutions had possibly led to a state of anomie among populations. Some felt that society had become a society of strangers. Science and technology had promised the eradication of disease but only created more new ailments and moved into wars (Hossain & Karim, 2013).

Therefore, in light of the above, postmodernism could be interpreted as a reaction against modernism and enlightenment in particular. Postmodernism could be viewed as the rejection of science as the ultimate truth. Truth itself became a matter of perspectives rather than verifiability (Hossain & Karim, 2013). Postmodernism moved away from the logic of reason, as reason could possibly be white, male and Eurocentric. The discourses of peace and progress were in fact discourses that were imposed by those in power (Hicks, 2004). Analysing learning in metamodern era provided insights into the oscillations from constructs of modernism to postmodernism.

Moreover, postmodernism is also presented as a new form of sociological enquiry (Preda, 2001). It could also be a new way of sociological analysis and expression. In a way, postmodernism calls for solidarity and concerted actions in the face of individualism and markets, for instance. Human nature is a collective rather than a mere collection of individuals. Postmodernism therefore distanced itself from individualism and reason that has generated capitalism and other liberal forms of governance and technology. Grand narratives such as socialism, capitalism and texts that claim objective meanings and true interpretations are at odds with postmodernism. These texts and narratives can be deconstructed. Objectivity could give way to other forces that could shape worldviews such as race, gender and other group memberships. Deconstruction could be a way to reveal these new forces since it meant going beyond the evident meanings and underpinnings of social phenomena (Derrida, 1974; 1978).

Finally, it is appropriate to end this sub-section by briefly discussing the information and media as a key characteristic of postmodernity. Information and media can be seen in the light of the concept of hyperreality of Baudrillard (1994). Hyperreality refers to the situation where an image cannot be related to any precise social reality. The image can have an existence of its own, not necessarily

related or conveying the same meaning as the social reality to which it could be traced back. In hyperreality, the distinction between the real and the imaginary is blurred. It could even be difficult to know where one stands; what could be real and what not (Robinson, 2012). Venturing into the different eras allowed the researcher to delve deeper into why the learners were learning in specific ways through the digitised learning resources.

3.3.2 Education and postmodernism

The primary goals of education for postmodernists were to understand one's being and give a social identity to learners (Hicks, 2004). Postmodernists thought in line with the above and did not believe that education systems needed to augment learners' cognitive abilities in order to produce fully functioning citizens or workers in adulthood. These 'new times' (postmodernity) have been posing a number of challenges to educational practices. Indeed, in these new times, leaners can be afforded a diversity of learning experiences and technology could be one of the major factors that have opened up access to new learning experiences. Technology could be transforming social relations and providing new means of communication and learning (Dau-Schmidt, 2001). The learners' exposure to digital technologies at a young age is probably causing some educationists to reconsider their views on patterns of cognitive growth. It could possibly be more difficult to identify what is developmentally appropriate for a learner of a specific age given the impact of digital technologies (Zimiles, 2000). In response to the postmodern challenges (including technological issues), attempts to integrate contextual and socio-cultural factors into developmental practices were made (Goffin, 1996; Stott & Bowman, 1996). This study brought knowledge on the extent to which technology helped in transforming social relations and bringing specific patterns of cognitive growth when learners learned through the digitised resources.

Following from the above, postmodern education has also been conceptualised as a tool box in a globalised world. Popkewitz (1999) saw postmodern education as an analytical toolbox that could allow learners to make sense of the boundaries and opportunities available to them. One way to devise such an analytical tool could be read from Usher and Edwards (1999). They proposed a

three-tier approach to postmodern education. The first part of this strategy is to learn from a multidisciplinary lens. Working on a subject matter from different perspectives could generate productive and creative interactions. This could in fact resonate with the idea of 'creation' in 21st-century skills. The second part is to have multiple readings of a given subject area. This could be linked to Foucault's (1980) idea of challenging regimes of truth. Multiple readings resonated with the idea of deconstruction. This may imply a reading of social life to reveal underlying truths. The third and last aspect of Usher and Edwards' (1999) approach was promoting a visual culture in learners. A visual culture according to Usher and Edwards (1999) could be a possibility to understand multiple perspectives in a diverse world. These three strategies can be used in conjunction with each other. This view has been used at university level to enable learners with the relevant analytical toolbox (but could nevertheless be insightful for the study). Indeed, this study shed light into how far learners learning through digitised resources in the 21st century generated creative representations of their learning to display the diversity of their understanding of the world.

Furthermore, it has been argued that the education process in postmodern times needed to be reconsidered as far as cognitive and affective domains were concerned (Esi & Posteucă, 2014). The educational process has always tended to be quite rigid. Normally, this process would move linearly from teaching and learning activities and then to evaluation. For Esi and Posteucă (2014), even digital technology sometimes seemed to be aligned with this canonical educational methodology. Therefore, it would appear that the foundations of modern education practices are not really challenged in spite of some awareness that modernity itself may require rethinking. Indeed, binomial relationships such as teacher-pupil or assessor-rated are hardly being contested (Esi & Posteucă, 2014).

Actually, postmodern epistemology is often portrayed as being beyond the reasonable and logical since the reasonable and logical are not the postmodern way to gain knowledge (Kilgore, 2001). Knowledge from postmodern lenses could be tentative, multifaceted and uncertain. Teaching from this perspective could be described as being a facilitator and guide (Yilmaz, 2010). Learning was

about deconstruction. Furthermore, for postmodernists, truth and identity were not fixed. They could be descriptions in language that were deemed as true and real in contexts (Derrida, 1982; Singh, 1995). Identity could hence be interchangeable and subject to social factors. Regimes of truth could evolve according to who has the power to make them shift. Various perspectives on a given phenomenon could be all equally true (Hansen, 2010). However, given the epistemological assumptions of postmodernism, two observations could be made. Firstly, it would not be out of place to be sceptical about the conceptualisations of teaching and learning. Secondly, if all conceptualisations were equally true, would it mean that 'anything goes'? Dybicz (2010) believed that the 'anything goes' stance is promoted when science is ignored. Postmodernism should be regarded as 'consciousness erasing'.

Moreover, the idea that 'anything could go' appeared to have created apprehensions among some researchers. Indeed the postmodern epistemology probably required a paradigm shift in education (Smith, 1997). This shift implied a movement away from modernism's 'truth' defined as 'scientific methods'. This movement was presented as the 'anthrax' of the intellect (Locke, 2002). In spite of these fears, others (Nylund & Tilsen, 2006; Gergen, 2012) believed that postmodern stances in education could promote critical thinking and more engagement in the learning process.

Furthermore, this movement away from modern educational practices could be grounded in the praxis of Freire (1999). In adult learning in particular, Freire's (1999) cycle of theory – application – appraisal – reflection has been used. Freire's (1999) pedagogy is seen to be moving away from conceptualising the teacher as the sole repository of knowledge. A dialogical approach is warranted whereby the voices of learners are foregrounded and teachers are reconceptualised as participants-managers (Allen, 2003). Giroux 1983 (as cited in Allen, 2003) has proposed postmodernism as a set of new conceptual tools for both learners and teachers (Allen, 2003). These tools could be helpful for awareness raising as well as for the deconstruction of taken-for-granted knowledge. Even for assessment, collaborative approaches are deemed appropriate. All voices are deemed valid (teachers and learners). This approach

could be a step forward to equalising power relations that could exist in the classroom or learning situation. From this perspective of Giroux (1983), it could also be important to provide the learner with different options to learn, to achieve a learning goal, technology being one of these options (Allen, 2003).

Indeed, postmodern pedagogy appeared to be a contestation of regimes of truths. This apparent contestation has resulted in revolutionary pedagogies such as contraband pedagogy of McLaren (2002). McLaren (2002), blending postmodern social theory and Marxists insights, guarded against neoliberal commercial solutions for education. Technology could fall into that category. These solutions could be focused on surveillance and on social control rather than the provision of genuine learning solutions to learners. Revolutionary pedagogy could possibly be an attempt to give recognition to non-participants in the educational sphere. Learning as predefined by national curriculum standards and exams is not considered as authentic learning. This study sought to explore whether learning through digitised resources prompted learners to promote authenticity in their learning.

The above could be a reminder that learners are central to the learning process, and could be stating the obvious. However, postmodern thinkers mentioned above tended to think that learners could probably not have a voice, or their voices would be suppressed or even oppressed. Adding to the above, some researchers (Coates, 2007; Shroeder, 2004) believed that teachers are facing different types of leaners in the digital age. These learners, termed as digital natives by Prensky (2001) are surrounded by different digital tools and their profound interactions with the digital tools provoked them ‘to think and process information in different ways compared to their predecessors’ (Prensky, 2001, p. 1).

At this stage it could be appropriate to find some resonance with the previous chapter, the literature review. Kivunja (2014) believed that it was essential for educationists to understand how learners learn. Indeed, as facilitators of learning, this is deemed crucial. In this regard, different learning theories were explicated in the previous chapter. The focus of this study is indeed to arrive at an

understanding of learners' learning through digitised learning resources. Postmodern conceptualisations of the learner could therefore be helpful. Prensky (2001) is often credited with one of the most insightful views on 21st-century learners or digital natives. According to Prensky (2001), digital natives are 'wired' differently due to their exposure to digital technologies.

Other authors tended to concur with Prensky's views. Kelly, McCain and Jukes (2009) also subscribed to the view that there could be a mismatch between schools' Industrial Age orthodoxy and learners' engagement with new digital tools. This could be the same mismatch identified by Coates (2007) and Shroeder (2004). From this perspective, learning is not conceptualised as a linear, canonical activity (Esi & Posteucă, 2014). Learning could be about random access, multimodal and multimedia. Creation, blogging, games and simulation are part of the learning process in this digital age.

Similarly, Tapscott (2008) carried out a study to find the truth (though truth probably could be at odds with postmodernism) about this new type of learner. For Tapscott (2008) learners in this era could crave for freedom, freedom of choice particularly. Learners in this age could also like to make things on their own. They are natural collaborators and would enjoy conversing rather than passively listening to a lecture. They would also favour open learning environments where people honestly share, create and collaborate. Fun could be the underlying motivation factor, even at school. Tapscott's finding could probably resonate with the ideas of McLaren (2002) of escaping control, genuine participation and search for more engagement in the learning process (Nylund & Tilsen, 2006; Gergen 2012). This study tried to analyse whether learning with technology promotes engagement, interest and fun among the learners.

3.4 Metamodernism

Section 3.3.1 gave an overview of postmodernism and its relevance to education. However, in order to have deeper insights into 'metamodernism', it was felt worth explaining the different conceptualisations of metamodernism. This provided clear insight into the oscillations occurring within metamodernism.

3.4.1 Conceptualisations of metamodernism

It would seem that there could be two different conceptualisations of metamodernism. Metamodernism firstly seemed to have arisen from the abandonment of the postmodern condition (Vermeulen & Van den Akker, 2010). From this conceptualisation, metamodernism could possibly be seen as an attempt to surpass postmodernism. Metamodernism is described as a crisis-ridden period; history is moving too swiftly, contradicting Fukuyama's (1989) claim that history has ended. It could be also described as an age of accelerations (of technology and climate change in particular) where the democratisation of digital technologies and tools has made the postmodern world based on television and the cyberspace obsolete. From this perspective, it would appear that metamodernism is a rupture from postmodernism.

Secondly, following Damico (2017), metamodernism can be viewed as an amalgamation of postmodern, modern and premodern ideas. Metamodernism in this sense could be an attempt to mash-up post-enlightenment, enlightenment and romantic notions. This synthesis is justified by the thought that this synthesis could be a positive force to move the human civilisation forward in the 21st century (Damico, 2017). Both notions of metamodernism appear to be pitched against the cultural effects of postmodernism. In particular, metamodernism would seem to be a reaction against the alienation from society that postmodernism could have created. Metamodernism, from both perspectives, would also seem to be against the 'anything goes' nihilistic idea (Dybicz, 2010). Therefore, this sub-section will deal with these seemingly different notions of metamodernism. Firstly, how metamodernism could be a unifying concept will be discussed. Secondly, the rupture aspect or concept will come under scrutiny. Lastly, the section puts forward the metamodern concepts of creative amateurs and naïveté (Latour, 2012).

3.4.2 Metamodernism: Unification and rupture

Metamodernism can be seen as a novel approach in philosophy, literature, arts and other spheres of human activities (Kadagishvili, 2013). The preconditions for the metamodernism movement appear to be modernism and postmodernism.

Indeed, without these two preceding moments, there would be no metamodernism. Metamodernism is seen as a return to sincerity and seriousness contrasting with the cynicism and pessimistic zeitgeist of postmodernism. However, this did not mean a naïve return to the sincerity of modernism. This may be a recognition that most of our institutions, such as the political and the educational systems, still function with modernists standards. Section 2.2 in chapter 2 was indeed a review of modernist standards in education as far as learners' learning is concerned.

The return to 'old' conceptualisations, however, does not deny the contributions of postmodernism. Indeed, both modernism and postmodernism are presented as foundations of metamodernism. Therefore, concepts such as sincerity are repackaged as new sincerity; materialism is re-invented as new materialism. In this sense, metamodernism could be seeking to go beyond postmodernism in two ways. Firstly, by combining modernist ideals and postmodernist insights, positive change could be achieved. Secondly, this combination could also provide solutions to numerous issues that appear to cause nihilistic and ironic feelings to arise in postmodernism. These issues could be climate change, anomic societies and unbridled capitalism.

More evocatively, metamodernism could mean a return to metanarratives. Examples of metanarratives in the case of this study are behaviourism, cognitivism and constructivism as discussed in section 2.2.2 of Chapter 2. Furthermore, metamodernism could also presuppose a return of hierarchies. This could be interpreted as a reaction to the flat moral landscape of postmodernism that could be more aligned to the 'anything goes' philosophy. Ethical hierarchies, for instance, could be making a comeback; love is portrayed as better than war as an example of an ethical hierarchy. This could appear to in contradiction of postmodernism that supported deconstruction of such hierarchies. However, no hierarchies could also be the reason why postmodernism found itself at a dead end. Probably no progress on the cultural, social and political fronts was possible with a flat moral landscape. This study strove towards an understanding of learning in the metamodern era where learning could occur as a result of an amalgamation of the grand narratives or a return to hierarchies.

However, as mentioned above, one must guard against presenting metamodernism as a naïve return to meta narratives and modern positions. Metamodernism is presented here as a structure of feelings; feelings that oscillate between diametrically opposed positions. Each time the structure of feelings moves to a given position, it is pulled back to its diametrically opposed position. For example, despair could be pulled back to hope and vice-versa. This oscillation is what could probably cause society to move ahead. This discourse could be used to analyse why the learners were learning in the ways they did through digitised learning resources.

In their metamodernist manifesto, Vermeulen and Van den Akker (2010) tried to identify the contour of this pattern of thought. Vermeulen and Van den Akker (2010) viewed oscillation as the natural pattern of metamodernism. This is what could be making the world move. Humans are also seen to be as nostalgic and futurist. This could mean that as we try to use and adapt to new trends and technologies, we could also be somewhat reluctant to let go past practices and theories. To fully grasp the contours of this emerging feeling that is metamodernism it could be helpful to understand two ideas that could have been foundational elements to metamodernism: hypermodernity and digimodernity. Hypermodernity refers to a level in society where it is believed that history may not be a valid indicator for our possible future, given the rapid advancement in knowledge, medicine and technology (Luebeck, 2015). It is argued that on the one hand, advances are being made very quickly with the proliferation of technology and on the other hand, the system is not fully supporting the advancements being made. The rules of the society are not being considered the same way for different people, thus causing individuals to view progress in multiple ways (Luebeck, 2015). This argument is also valid for the study as technology is gaining ground in education whereas the classroom environment or teaching strategies used by the teacher do not fully support and promote the advancement in teaching and learning. This dissonance could influence the way learners negotiate their ways to enunciate meanings to the concepts that are taught to them. Moreover, with the internet becoming more and more ubiquitous in our society, it and other technologies have exceeded our imagination (Mulady,

2010). They have shaped our society in so many ways that consumers have broken free of the modernistic constraints and quickly adapted to the change (Mulady, 2010). This phenomenon indicates that we are no longer solely in a postmodern society but have started to shift into a new paradigm where the society is influenced and dependent on technology (Mulady, 2010). Kirby (2009) calls this shift digimodernism. The consumer has become very actively participative and knowledgeable through varied media in this digital world so that it is difficult to come to terms with postmodernism where the consumer was more a passive receiver.

Postmodernism could have been put to a sudden death by material events such as climate change, financial crises, terror attacks and the digital revolution. Otherwise, postmodernism could have been put to a slower death by identity politics and queer theory. The important question asked by Lipovetsky and Charles (2005) was what postmodernism has been abandoned for. His answer was for hypermodernity. Hypermodernity could be characterised by deep transformations of our daily lives, in particular the way in which we deal with time. Indeed, the availability of digital technologies has enabled human societies to transcend geographical and time borders. Everything in this so-called digital age is ‘hyper’. More could have been the motto; more profits, more innovation more performance. There appeared to be an acceleration of forces such as markets and technology. This acceleration could have probably caused a meltdown of social constraints. However, these very accelerations could have been the heart of conflicts that is possibly causing a resurgence of the past.

Furthermore, postmodernism has been equated with consumerism (Mulady, 2010). Greed and dissatisfaction arose from consumerism induced by postmodernism. Choice, which could be presented as a positive aspect of rising consumerism had also probably increased. Technology could have been a cause for the above. It this same technology, or rather the progress in digital technologies, that may have been the cause of death of postmodernism (Eshelman, 2008; Lipovestsky, 2005). Technologies are probably more and more integrated in our lives. Digital technologies, moreover, enable humans to interact with them. We could be shaping technologies as much as they are shaping us.

The interactive aspect could mean that we are not going to be conquered and ruled by digital technologies. There could probably be a dialogue between human needs and digital technologies. Samuels (2010) has pointed out the positive impact of digital technologies and interaction on postmodernism. He probably sees no reason to be pessimistic about technologies as humans are able to enter technological flows and have immersive experiences. These experiences probably would not deny human beings from humanness. This study brought knowledge and understanding on the type of experiences and interactions that learners had when they learned from digitised resources and whether they were really conquered and ruled by the digital technologies or not.

To add to the above, these new conceptualisations of technology could make it more difficult to distinguish between human and non-human agencies. Technology could possibly have agency, even more so in the digital era (Fernandez, 2016). One key precept of metamodernism, new materialism, could probably give some insight. New materialism focused on the interrelations between the technological, biological, environmental, and social processes of human activities (Fernandez, 2016). New materialism, unlike materialist thinking, did not contend that matter could be inert and predictable. Matter could be active and unstable; far from predictable. Hence, the focus of new materialism could be the dynamism and agency of matter (technology in the case of this study). From the dynamic nature of technology and the interactions with human users, phenomena (such as learning) could arise. This way of thinking could not have been possible with postmodernists. From the new materialist perspective, metamodernism could be trying to do what postmodern failed to do (Hekman, 2013). This study endeavoured to provide an explanation as to whether the new materialist perspectives manifested when the learners learnt through the digitised learning resources.

Moreover, oscillation, being probably the nature of things in metamodernism, has created paradoxically opposed combinations of ’traits’. For instance, movies are sometimes characterised by cynical reality of adults and childlike naivety at the same time. The ecology of drama is possibly subjected to oscillations between the real and the imaginary. Even non-human actors act in the metamodern drama

ecology (Brereton, 2016). Oscillation could be multipolar, contrasting with modern and postmodern dualities. Deconstruction is met with reconstruction. Meaning could appear vain in this case. However, meaning could also possibly be about navigating the metamodern. The notion of expert itself could be deconstructed with digital media. Indeed, with the availability of digital technology creation is not exclusively reserved to a handful of experts (Clarke, 2014). Anyone could create. Even if some creation might seem trivial, it would not mean that they were not creations after all (Vermeulen & Van den Akker, 2010). Expertise deconstructed is reconstructed as creative amateur; knowledge probably could oscillate towards naivety. Furthermore, creation is increasingly becoming interdisciplinary and multidisciplinary (Kadagishvili, 2013). Expertise deconstructed is probably reconstructed through borrowing from a multitude of fields. The metamodern could be about cross-fertilisation through encounters of the analogue, the digital, and the biological (Colman, 2014). This oscillation or cross-fertilisation may affect how learners learn through technology. This study tried to analyse how learners' learning through digitised learning resources in the metamodern era could be a result of the reconstruction or deconstruction of knowledge or expertise where learners might be creative amateurs.

3.4.3 Metamodernism: A break from postmodernism?

Postmodernism is a school of thought that started after World War II, but became popular in the 1960s and 1970s (Yousef, 2017). Later, in 1979, Lyotard (1979) defined it as postmodernism. Postmodernists argued that there are no absolute truths and that things are irrational (Yousef, 2017). Modernists' rationality was questioned and postmodernist believed in chance and transience (Yousef, 2017). The concept was not well defined and operational, yet another approach of higher complexity grew up from this theory and it is called metamodernism (Baciu, Bocoş & Baciu-Urzică, 2015). Despite the fact that the explanations on modernism, postmodernism and metamodernism are associated with a specific era, there exists a dynamic relationship between the three concepts as interpretive systems and philosophical currents (Baciu et al., 2015).

Baciu et al. (2015) believed that the three concepts are somewhat overlapping and have specific contribution to ensuring the overall development of an

individual. Based on several definitions of postmodernism, the key words that characterise the postmodernism are mainly ‘scepticism’, ‘subjectivism’, ‘relativism’, ‘mixture of different artistic styles and media’, and a ‘general distrust of theories’ (Oxford Dictionary). So, the characteristics of the postmodern individual are described by the terms above. These key terms maybe are used to explain the individual’s character that may eventually determine the characteristics of learners and their learning in the postmodern era. Postmodern authors often reject the boundaries between different genres (Yousef, 2017). Meanwhile, Lyotard (1979) also believed that the values of order and stability characterised by modernism are derived from ‘grand narratives’ being popular in the Age of Enlightenment and beyond. He argued that with the advent of technologies and techniques, ‘little narratives’ are better to explain social transformations and political problems and he defined ‘postmodern’ as ‘incredulity towards metanarratives’ (Crane & Amawi 1997, p. 303). Lyotard argued for the decrease in effectiveness of grand narratives in the postmodern era as people became more alert to difference, diversity, beliefs and desires and he called postmodernity an abundance of micro narratives (Yousef, 2017). However, these characteristics started to lose their significance at the start of the 21st century where technology invaded the lives of people.

This 21st-century era was discussed in light of the metamodernism concept. The latter oscillates from the postmodern to the modern era. It is indeed not a total break away from the postmodern era but oscillates from one polarity to another (Kadagishvili, 2013). On the one hand, postmodernism is playful, insincere, unsteady and ironic (Kadagishvili, 2013) and on the other hand Vermeulen and Van den Akker (2010) view metamodernism as a non-stop action and a ‘constant repositioning’ between position and mindsets (Kadagishvili, 2013). The metaphor ‘pendulum swinging’ could be used to explain the oscillation occurring in the metamodern era. Nevertheless, there are still important concepts from the previous era that were reviewed in order to understand the social behaviour of individuals in the 21st century with more exposure to information through technology. The people’s beliefs, attitudes, desires and many other ‘micro narratives’ or ‘meta narratives’ as defined by Lyotard in the postmodern era might

be repositioned or questioned based on basic principles called ‘grand narratives’ from the modern era. Often, metamodernism is also referred to as post-postmodernism or neomodernism. It tries to respond to the current cultural mode and it presents the ‘idea that faith, trust, dialogue and sincerity can work to transcend postmodern irony and detachment’ (Yousef, 2017, p. 37). It represents the trend of contemporary societies expressed through a new philosophical lens considering the existing opportunities and challenges of the current society and, in this study, the current technology-embedded classroom. With regard to this study, this was an important frame to analyse the learning process in a classroom where the setting promotes a set of ‘narratives’ as in the postmodern and modern era while the inclusion of the interactive projector or the digital device tried to project a different cultural mode. The learner had to process the information based on the training from early years of schooling in a traditional set-up to a multitude of dominant features in a digital classroom. The learner could oscillate between ‘modern enthusiasm and a postmodern irony, between hope and melancholy, between naïveté and knowingness, empathy and apathy, unity and plurality, totality and fragmentation, purity and ambiguity’ (Vermeulen & Van den Akker, 2010, p. 6).

To better explain the concept of metamodernism, being the oscillation between modernism and postmodernism, the researcher decided to better represent theoretical framework used for this study in a diagrammatic form in Figure 3.1.

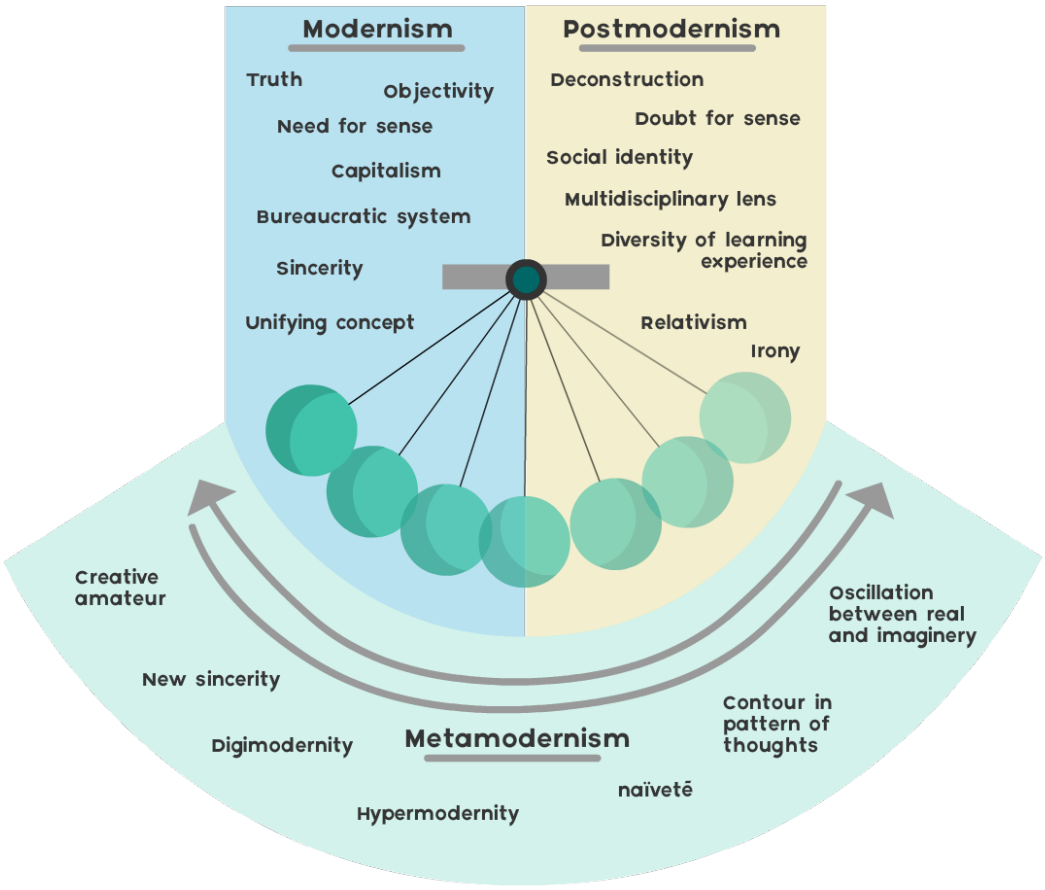


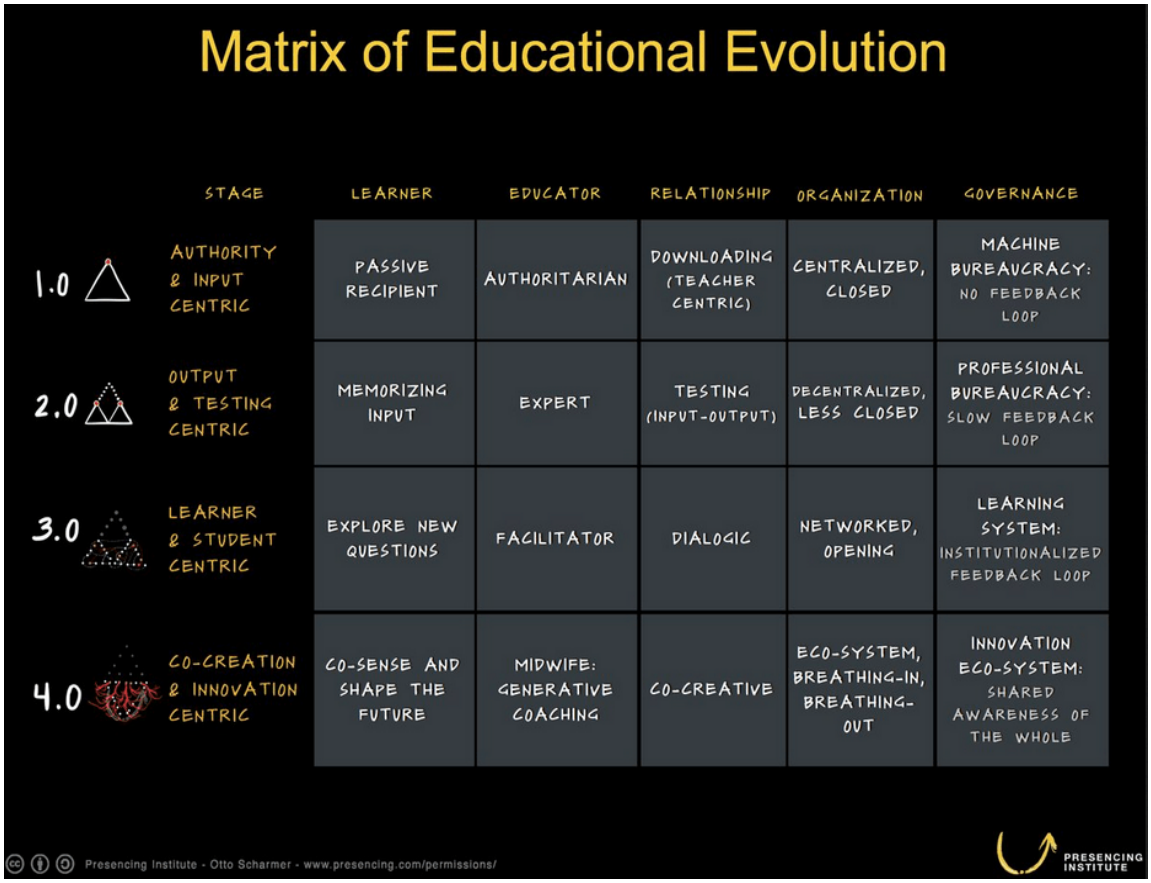
Figure 3.1: Representation of Metamodernism

In Figure 3.1, the blue section on the left indicates 'modernism' where there was a need for sense and sincerity towards grand narratives. It was an era where science was taken for the ultimate truth, as there much objectivity in learning. The grey section on the right represents the postmodernism where there was a rejection of science as the ultimate truth and the grand narratives were deconstructed. The blue/green section represents metamodernism where there was deconstruction and reconstruction. It shows the oscillation from modernism and postmodernism where there was a contour in the pattern of thoughts and a return to hierarchies. In metamodernism, the positions and mindsets of individuals were repositioned.

3.4.4 Education and metamodernism

Metamodernism has also been taken into account regarding education throughout the world. The education system has provoked considerable change in the learner and the educator, thereby bringing about new dimensions to teaching and learning. Table 3.1 presents an overview of the possible changes in the learner and the educator in line with evolution in education from education 1.0 to education 4.0. As advanced by Scharmer (2009), the education 1.0 was the era when the teacher was considered as the sole repository of knowledge and had an authoritarian role. In education 1.0, learners were passive recipients of knowledge. Then came education 2.0 where the focus was laid on memory. Testing was put at the centre and learners had to learn to pass a test. The teacher in education 2.0 was viewed as an expert. In education 3.0, the approach moved from a teacher-centered to a more student-centered one. The learners were given opportunities to explore new questions. The role of the teacher was that of a facilitator. The last evolution is education 4.0 where knowledge was co-created by the teacher and the learner. The focus was laid on shaping the future and equipping learners with specific skills. The role of the teacher changed from a facilitator to a co-creator. Table 3.1 maps out the evolution of education with regards to the stage, learner, teacher, relationship, organisation and governance.

Table 3.1: Layout or Educational Evolution Processes



Source: Scharmer (2009)

Table 3.1 shows that there is one advanced education level called education 4.0 where the learner is no longer the passive receiver of knowledge and the educator, the sole repository of knowledge. Moreover, there is a shift from student-centric to co-shaping the future. Indeed, the learner co-creates knowledge together with the educator and peers to better shape the future Scharmer (2009). The five facets presented by Scharmer (2009) indicate the underlying notions of our belief system in education and how it is linked with old patterns and emerging new ones. Thus, this study sought to bring a deeper understanding into the roles of the learner when learning through digitised resources. Consequently, this study could also inform the role of the teacher when digitised resources is actually used.

Although the learner is constructing or co-constructing knowledge, skills and attitudes, learning new things still prevails, which means that both the

constructivism, enactivism and cognitivism stand true in a metamodern world where technology dominates. This study tried to analyse how the learner made sense of the concepts being taught by the educator and why they learnt them in such ways. Metamodernism was chosen as the frame to analyse learning in the digital classroom as it clearly reflects the dynamic nature of the digital classroom where the learner has to negotiate between his teacher's explanation and the resource to make sense of the concepts. 'Metamodernism is dealing in the digital age and the internet communication' (Hashim & Puadi, 2018, p. 916). Hashim & Puadi (2018) pointed out that everyone can communicate synchronously or asynchronously at a distance, yet they share the same feeling, idea and thinking. He also added 'metamodernism celebrates diversity and difference and the multiple subjectivities show the reflection of how they develop, interact, intersect and in time help form our individual and collective identities' (Hashim & Puadi, 2018, p. 916).

3.4.5 The metamodern logic: Creative amateurs

Learning is constantly changing with the evolution of the modes of communicating or exchanging information. The currency for success in the job market of today depends largely on good communication skills and overall development of the individual. Hence, teachers are confronted with the challenge of better preparing learners for their future careers, which will be characterised by the learners' ability to be functional in rising automated sectors. Classrooms of today are equipped with digital devices and learners are constructing or co-constructing knowledge through these devices. The questions that we might ask ourselves: How far are we really trying to measure the excitement vs the naïveté of the learners in response to the concepts presented in the digital resources? Are there really new modes of learning demonstrated by the learners? Why are the learners responding in such ways?

These questions helped me to carry out an in-depth analysis of the learning process within a digital classroom. While the learners are users of technology, they are still learning other concepts. They had to learn the different techniques to interact with technology and learn the concepts pertaining to the lesson. Since they had been trained to learn through the static whiteboard and static images as

in traditional classrooms, with the introduction of the digitised learning resources, they had to oscillate between the way they used to learn through the static board and the new way of learning through the interactive whiteboard. One term that may be used to describe the learners in the metamodern world could be 'creative amateurs'. The next section describes the characteristics of creative amateurs and how they were used as frame to analyse the learners' learning through digitised learning resources in a metamodern world.

The naïveté and originality are present in the child's world. Very often, children can see houses, rabbits, elephant and dinosaurs when looking at the clouds. This explains how the child's mind can be creative. In fact, each individual has unique qualities to make metaphors out of our understanding of something and creativity is 'the art of living metaphorically' (Berc, 2018, p. 1). Indeed, creativity and curiosity are innate in all individuals and we are always ready to explore the world around us. Moreover, play helps a child to express creativity and this is the way learning actually happens. If the children's learning is meaningful and enjoyable, they will end up with creating wonders out of what they can see (Berc, 2018). As explained in Chapter 2, the revised Bloom's taxonomy has catered for this need by describing the highest order of thinking as being 'create'. The child cannot be termed as a creative professional like famous artists or painters but can become a creative amateur when given opportunities are given to create new things. In this metamodern world, the child still has to remember and understand specific concepts and at the same be creative in a unique way. This metamodern logic is clearly explained in the revised Bloom's taxonomy. This study added a new dimension to the process of learning as the learner has more definite roles nowadays through his interactions with the digitised learning resources with embedded features as well as the teacher, peers and content. These elements in the digital classroom make learning unique for each learner.

3.5 Conclusion

Metamodernism is the repositioning of mindsets, which emanated from the diversity of differences and the multiple subjectivities. In this chapter, the oscillation from modernism to postmodernism concepts was clearly explained

with relevant illustrations. Metamodernism was viewed both as a unifying as well as rupture concept. The metamodern era is a period where there is new sincerity and new materialism. The learners are also termed as creative amateurs where there is a contour in their patterns of thoughts. Furthermore, in the metamodern era there is an emergence of opposed combination of 'traits' which oscillates between real and imaginary. The metamodern era was based on the ideas of hypermodernity and digimodernity. Hypermodernity refers to the rapid advancement of technology in education where history is no longer a convincing indicator of our future, whereas digimodernity refers to the learners being digital natives and ultimately computer savvy. In the metamodern era, both hypermodernity and digimodernity confluence and this may eventually impact on the learner's learning through technology. Since the study was about learning through digitised learning resources, metamodernism was used as the lens to analyse learning. The next chapter will outline the procedures that were used for the research design and methodology. This will provide the reader with a detailed description and justification of how the research was conducted to collect data about learners' learning through the digitised learning resources. It will also present the ethical considerations while conducting the research.

Part 3: Researching learners in the digital classroom

Chapter 4: - Research Design and Methodology

4.1 Introduction

In the previous chapter, the theoretical framework was described. Metamodernism was the frame used to interpret learners' learning through the digitised curriculum. Theoretical and conceptual clarity were also discussed in the previous chapter. In this chapter, the research design and methodology receive attention. The chapter opens up with a discussion on the paradigm and approach used for this research. The ontological and epistemological stances with respect to the phenomenon are detailed here. The study was situated within an interpretivist paradigm that sought to develop an understanding of the phenomenon, which was learning through digitised learning resources. Then a detailed description of the methodological stance, mode of inquiry, selection of sample and sampling procedures is presented with justification. Moreover, the qualitative research design as well as an elaboration of the instruments used in this study are detailed. Then, a description of the procedure for data collection and methods adopted for data analysis is given. Finally, endeavours to address ethical issues and ensuring trustworthiness and authenticity form the concluding section.

The aim in this study is to present explanations as to why learners learn the ways they do when using digitised learning resources. It is in fact not a mere description of the phenomenon, which is learners' learning, but an explanation of the outlines of the phenomenon. The study focuses on how learners are making sense of the concepts learnt using digitised learning resources and why they are such in a digitised classroom where the pedagogy may not be adapted to the modern forms of teaching and learning.

This chapter starts with a description of the research design and the design choices are justified. The research questions are restated to better craft the research design, and explain the design choice. Thereafter, this chapter presents a description of the methodology adopted to capture learning through digitised learning resources among children of Grade 4. The sources of data and data collection methods, which are multi-layered, are also described in this chapter. The instruments that have been developed for the purpose of this study largely support the qualitative nature of the study.

4.2 Section 1: Research Design

The research design refers to the planning of a research to effectively address the research problem. It consists of the overall strategy chosen to incorporate the different components of the study in a logical manner (De Vaus, 2001). It is a blueprint for data collection and analysis of the research problem reflects on the type of research design used in the study.

4.2.1 Epistemological stance – Interpretivist stance

According to Collins and Stockton (2018), there are three dimensions of the research process: epistemology, ontology and methodology. The epistemology refers to the nature and scope of knowledge and justified belief (Hirschheim et al. 1995). The ontology refers to ‘a description of the concepts and relationships that can exist for an agent or a community of agents’ (Gruber, 2018, p. 2) and the methodology refers to the practical investigation of the researcher to find out whatever is believed can be known. Epistemological questions respond to issues such as ‘how can reality be known?’ and the relationship between the knower and the known. Epistemology also considers the process and characteristics through which knowledge is found and the possibility whether these knowledge-gaining processes can be shared and repeated by others (Vasilachis, 2009). Underlying philosophical assumptions about what constitutes a valid and reliable research and the most appropriate research methods for the development of knowledge in a given study are foundations of all research. This section explains the philosophical assumptions and design strategies underpinning this research study.

Normally a person's worldview has significant influence on the perceived relative importance of the aspects of reality and these are predominantly the ontological and epistemological aspects of a research. These different facets of viewing the world have great impact in most academic arenas but none is considered as better than any other (Cohen, Manion & Morrison, 2011). Guba and Lincoln (1994) distinguished the research paradigms as positivist, post-positivist and postmodernist enquiry, and assembling post modernism and post-structuralism within 'critical theory'. There are two different worldviews, namely the objectivist and the subjectivist. The philosophical basis adopted by the objectivist (positivist) is realism where the world exists and is knowable as it really is (Cohen, Manion & Morrison, 2011); in contrast, post-positivism assumes that this 'reality' is only 'imperfectly and probabilistically apprehendable' (Guba & Lincoln, 1994, p. 109). Despite that post-positivism is an extension of positivism, they both have the objectivist philosophical base.

A subjectivist epistemology is more in favour of 'critical theory' where 'the investigator and the investigated object are assumed to be interactively linked, with the values of the investigator… inevitably influencing the inquiry' (Guba and Lincoln, 1994, p. 110). Furthermore, three philosophically distinct categories of research paradigms are classified as positivism, interpretivism and critical postmodernism (O'Donoghue, 2018). Paradigms play a fundamental role in research. A paradigm is best described as 'a whole system of thinking' (Neuman, 2011, p. 94). In the natural sciences, paradigms are largely 'hidden' in the research work but they affect the practice of the research (Creswell, 2009). The research paradigm encompasses the interrelated practice and thinking that define the nature of enquiry. Research paradigms reflect our beliefs about the world we live in and want to live in (Lather, 1986). After consultation of common philosophical assumptions, the interpretive paradigm was identified as the stance to adopt for this study.

People give meaning to the social world and the social phenomena can be understood through the meaning and interpretations that people give to the social phenomena (Thahn and Thahn 2015). The interpretive paradigm attempts to understand and interpret the world in terms of its actors (Cohen, Manion &

Morrison, 2011). Furthermore, interpretivists have the belief that knowing the social world is not delivered through a single channel nor through a single method (Smith, 1993; Willis et al., 2007; O'Donoghue, 2018). Since the interpretivist paradigm was chosen for this research, the researcher approached reality through the learners' interactions they had through the digitised learning resources within the digital classroom. Since reality is subjective and constructed, the interactions included the peer-peer, learner-teacher and learner-resource. Moreover, the findings of the research emanated from multiple sources and perspectives and this provided an insight into how the different learners made sense of the different concepts they learnt through digitised learning resources and why they were learning in such ways. Hence, in this study, the social world was understood from the standpoint of learners who were actually involved in the research (Cohen et al., 2007). Interpretivism helped the researcher to bring into new knowledge about learning through hidden social forces and structures in a metamodern era (Cohen et al., 2007).

4.2.2 Ontological stance

Based on the subjectivist epistemology, the researcher positioned the study within the interpretivist paradigm and the ontological assumptions adopted in this study, relate to 'what is reality' (Crotty, 1998, p. 10). Different paradigms normally have different assumptions of reality and knowledge and this helps in determining the research approach, which is clearly reflected in the methodology adopted for the research.

Ontological assumptions relate to queries such as 'what is there that can be known?' (Guba & Lincoln, 1994, p. 109). In this study, the profiles of the learners varied with regard to cognitive levels and contexts and this brought in different meanings and interpretations of realities, which led to the use of various methods and techniques of interpretive design. For example, the researcher conducted a semi-structured interview based on learners' drawings to represent their learning of the concepts through digitised learning resources. Being in an interpretivist paradigm, the researcher's experiences had to be revamped from multiple perspectives as a researcher, as a lecturer in the field of curriculum and evaluation and as a former teacher. However, these different positions allowed

me to have diverse and varied perspectives to analyse learners' learning using the digitised learning resources at Grade 4 level in Mauritian primary schools.

According to Thanh & Thanh (2015). a primary assumption of interpretivism is that 'reality is socially constructed' (p. 25). In the same vein, Hussey and Hussey (1997) added that when people reacted in their natural societal milieu, they could better relate their own actions. In this study, the researcher observed the learners within their natural classroom contexts but with the interactive projector being included. This natural societal milieu helped me to get an authentic view of learning through digitised learning resources. The reality about learning was analysed from the empirical evidence on learning within a unique classroom context. The next section will present the approach used to collect these evidences of learning through digitised learning resources.

4.2.3 The research approach used

In this section, a brief explanation and justification of the approach used in the study is given attention. Three different approaches may be adopted in research, namely quantitative, qualitative and mixed methods. According to Newman and Benz (1998), qualitative and quantitative approaches should not be regarded as dichotomies. Any study may tend to be either qualitative or quantitative or mixed methods whereby the latter is located in the middle and integrates elements of both qualitative and quantitative approaches. Often, the words used in the research may be associated with the approach. For qualitative research, open-ended questions (like interviews) are used, whereas for quantitative research, closed-ended questions (like hypotheses) are preferred (Creswell, 2009). The research approach selected also determines the type of research strategies and methods used. For example, for quantitative research, experiments are used as the research strategy and instruments as method and for qualitative research, case studies may be the research strategy and observation as method (Creswell, 2009).

For the purpose of this study, a qualitative approach was used. The qualitative approach is meant for extracting meaning out of individuals' interactions 'ascribed to a social or human problem' (Creswell, 2009. p. 4). Hence, the researcher

interprets the findings. O'Leary (2004) posited that qualitative data might be obtained through words, visuals, or videos and analysed under thematic exploration (p. 99). Maree (2009) added that using the qualitative approach enabled rich and deep explorations of the research phenomenon. In the case of this study, a qualitative approach was used to arrive at a deep understanding of learning through digitised learning resources among Grade 4 learners.

Researchers using a qualitative approach do not purposefully manipulate the phenomenon under the research lens. In keeping with this approach, the study provided detailed description, interpretation and analysis of learning through digitised learning in a traditional classroom context. As such, the study provided meaning as to how Grade 4 learners were learning and why they were learning in such ways. Adopting the qualitative approach allowed the researcher to discover meaning in a naturalistic classroom context. The qualitative research approach was concerned with understanding the process of learning and the socio-cultural contexts about which little was yet known. Various behavioural and cognitive patterns were analysed to answer the 'why' research question in order to arrive at an understanding of learning through digitised resources. This in-depth analysis also allowed me to gain new insights on learning in the metamodern era where learning oscillates from postmodern to modern conceptualisations of learning.

4.2.4 Methodological stance – case study methodology

The methodological stance chosen to conduct the study was the case study methodology. Analysing learning through digitised learning resources using different cases allowed me to arrive at an in-depth meaning of the phenomenon. According to Yin (1989), a case 'refers to an event, an entity, an individual or even a unit of analysis' and a case study 'is an empirical inquiry that investigates a contemporary phenomenon within its real-life context using multiple sources of evidence' (Noor, 2008, p. 1602). Case study research is normally based on in-depth exploration of an individual or a group of individuals to investigate the phenomenon. Indeed, the case study methodology was chosen to be able to investigate how the learners were actually learning through digitised learning

resources within their natural classroom settings, using multiple tools to collect data about their learning.

According to Yin (2003), when the focus of the study is to answer the 'how' and 'why' questions, case study designs are preferred, as they do not allow the researcher to manipulate the behaviours of the participants. However, Yin also mentioned that using case study methodology does not allow for clear boundaries between the phenomenon and the context (Yin, 2003). When case study methodology is used, even the contextual conditions are considered, as they are deemed important to analyse the phenomenon.

Case studies are also designed to allow information to be gathered from the opinions of participants by making use of multiple sources of data. Yin (2009) came up with three categories of case studies, namely explanatory, exploratory or descriptive (Baxter & Jack, 2008, p. 547). According to Yin (2003), the explanatory case study would be used if the researcher is actually trying to explain the causal links in real-life interventions. However, the exploratory case study refers to exploration of situations the interventions have a myriad of outcomes (Yin, 2003). Furthermore, a descriptive case study is used when the study requires a description of a phenomenon and the context in which it occurred. He further separated case studies into single, holistic case studies and multiple-case studies (Baxter & Jack, 2008, p. 547). Moreover, a single-holistic case study might be used if the outcomes of the study can be generalised using only one case. This has been used in nursing where only one case was enough to research a problem. However, issues that might arise would be context-related issues and this is where multiple-case study helps in addressing this issue.

Multiple-case study is often selected because it allows the researcher to delve into the differences within or across cases. The main aim of multiple-case study is to arrive at an understanding of the phenomenon through different cases within or across different contexts. In this study, each participant had a unique profile and characteristics, which allowed the researcher to have richer representations of learning through technology among Grade 4 learners. Analysis of findings from cases studies are normally guided by theories and concepts. Regarding this

study, comparisons were drawn across cases and analysed against the literature reviews and theoretical framework. The rationale of choosing multiple-case study was to gather authentic empirical evidences of learning through digitised learning resources in real classroom situations. This array of versions of learning and experiences allowed the researcher to bring a contribution to the body of knowledge in learning with technology in a metamodern era. Moreover, with multiple cases, the researcher probes into a higher level of abstraction, to further answer the critical questions under investigation. For the sake of the study, different cases from three different schools were initially selected. More information about the selection of the cases will be given in the next section.

4.3 Section 2: Research methodology

This section presents the research methodology that was employed for conducting this study. Research methodology refers to 'a science of studying how research is done scientifically' (Kothari, 2004). This section details out the process used to gain entry into the field, the sampling procedures used, the data production methods and tools.

4.3.1 Gaining entry into the field

According to Van Maanen and Knolb (1985) and Johl & Renganathan (2010, p. 42), 'gaining access to the research field is very important and should be considered seriously'. It serves to negotiate environments, which are not familiar to the researcher, and social skills should be used effectively to successfully gain access (Wasserman & Jeffrey, 2007). Wasserman and Jeffrey (2007) further advanced that trust and acceptance should be gained to conduct the research within the environment, but this is not always an easy task as outsiders are often not welcomed if the research comprises questions that are quite sensitive to the organisation.

Gaining access to the field was one of the major challenges the researcher encountered when data collection started. Approval was sought from the MoE & Human Resources to gain access to the selected schools to conduct the research but it took about four months to receive the permission from the Ministry to access

the schools. The researcher had to revert to the Ministry on several occasions and finally access was granted to three schools of different levels, high, average and low levels (Appendix 2). In the Mauritian education system, the levels of schools are determined by the performance level of students. The high-level school also known as 'star' school is the high performing school and the 'low' level school is the low achieving school. In the average school, the projector was faulty. The researcher waited for two weeks for the interactive projector to be repaired but to no avail. Due to time limitation, the researcher had to remove the average school from the sample.

4.3.2 Sampling procedures

The researcher followed the steps in sample design and sampling procedures proposed by Kothari (2004) in his book *Research methodology: Methods and techniques* (p. 55-57) to carry out the sampling procedure. The researcher first tried to find the sample design. According to Kothari (2004), a sample design is 'a definite plan for obtaining a sample from a given population' (p. 55). Since the research approach used was qualitative, it was first decided to look for a finite universe or set of objects (Kothari, 2004, p. 56). The choice of the sampling unit was based on the geographical location of the schools. It was convenient for the researcher to access the two schools from work for data collection, as the distance from work to these two schools was relatively small.

The researcher then looked at the source list or the sampling frame, the size of sample and the parameters of interest, which will be detailed in the remainder of this section. Concerning this study, the sampling frame was government primary schools of different levels situated in different regions. The reason behind choosing three different schools was to get learners from different contexts, more precisely different socio-economic backgrounds that could be used to determine the access of the students to the technological devices at home or in their environment. Sandy Government School is located in an area where the socio-economic background of the families is average and the students' performance is at average level. Before embarking on the research, a small survey was done on accessibility of students with technological devices. The majority of students replied that they did not have easy access to technology. This acted as a key

indicator of the exposure to tools in the learners' environment. Moreover, Violet Government School is situated in an urban area. This school is labelled as a 'star' school as the students are mainly high flyers. From a survey done, it was found that the students in Violet Government School were technology savvy as they were conversant with the use of tablets, laptops or other technological devices.

The reason for choosing different levels of schools was to analyse how learners of different levels of performance actually learnt through the digitised learning resources and why they were learning in the way that they did. Despite the main phenomenon of the study being learning, the levels of learners could actually help obtaining a deeper insight into the process of learning. Since the approach used for the research was qualitative, the sampling frame did not necessarily represent the whole population but rather provided in-depth analysis of the learning process.

Sampling is a process or technique of choosing a sub-group from a population to participate in the study; it is the process of selecting a number of individuals for a study in such a way that the individuals selected represent the large group from which they were selected (Ogula, 2005). There are two types of sampling designs, namely probability sampling and non-probability sampling (Kothari, 2004). Probability sampling design is used when 'every item of the set of objects has an equal chance to be included in the sample' (Kothari, 2004, p. 60). Another term that is commonly used to address probability sampling is 'random sampling' or 'chance sampling' (Kothari, 2004, p. 60). Non-probability sampling design refers to the sampling procedure where the samples are chosen for a purpose and which are representative of the whole (Kothari, 2004, p. 59). In non-probability sampling, samples are chosen in a way that does not allow for all subjects in the population equal chance (Etikan et al., 2016).

The sampling procedure adopted for the study was non-probability sampling. Non- probability sampling 'does not require any estimation of the probability of each item' (Kothari, 2004, p. 59). Non-probability sampling can also be called 'deliberate sampling, purposive sampling, or judgement sampling' (Kothari, 2004, p. 59). In these types of sampling, the researcher deliberately chooses the

sample based on specific goals. The sample chosen is a representation of learning among Grade 4 learners of different cognitive levels and levels of exposure to technology. To be more specific, the researcher chose purposive sampling for selecting the participants in the research.

Purposive sampling is often referred to as judgement sampling or non-random sampling and it is a deliberate choice of the participants on the research (Etikan, 2016). In purposive sampling, the researcher's knowledge and experience were considered to select his participants in the sample. This type of sampling is very common in qualitative research as it helps to 'select information-rich cases' that better assist in answering the critical questions of the research (Etikan, 2006, p. 2-3). Compared to probability sampling techniques, purposive sampling demands relatively small samples but with rich information to analyse the phenomenon of the research.

The choice of the schools already being made on the socio-economic background and the academic level, the researcher had now to select one Grade 4 in each school. As clearly detailed out in Chapter 1, the Sankoré project started in all Grade 4 classes in Mauritian primary schools in 2012 and this was the main reason why Grade 4 learners were specifically selected. The researcher had to ensure that the interactive projector was present in the classes chosen for data collection and that the teachers and learners had enough exposure to the interactive projector. However, in Sandy Government School there were two sections of Grade 4 and in Violet Government School there were four sections of Grade 4 and the researcher had to decide which section to select for the research. The researcher asked the headmaster of both schools to guide me in the selection process. In both schools, the choice of the Grade 4 classes was based on the teachers' experiences working in primary schools either with or without the aid of the interactive projector. Moreover, the teachers chosen worked had at least three years of experience working with Grade 4 learners, which meant that the teachers were conversant with the curriculum and pedagogy required to work with Grade 4 learners.

Regarding the sample of participants, the class teacher assisted me in making the selection. The reason for asking the teacher to select the participants was that he knew the learners in his class. The researcher asked the teacher to select the learners according to their levels of learning. Hence, six learners of different levels were chosen in Grade 4 of the selected schools. Moreover, despite the fact that learners of different levels were chosen, yet the high flyer in Sandy Government School might differ from the high flyer of Violet Government School as the levels of these two schools varied. Sandy Government School was an average performing school and Violet Government School was a high performing school. Since, the researcher set out to discover and gain deep insight into the phenomenon, it was decided to select samples from whom the most could be learnt (Merriam, 1998).

4.4 Section 3: Research methods and instruments used

Our world is complex and it is hard to understand how people think and why they think in such ways. Qualitative research methods facilitate this process of understanding by providing rich interpretations of activities in society. In research, a wide range of tools and techniques are normally used and this is referred to as research methods (Walliman, 2011). Alignment of research methods with the research design and methodology enhances the quality of data gathered for future use in the study. Qualitative research methods are used to analyse the behaviour and perception of participants to arrive at a clear understanding of the phenomenon (Walliman, 2011). The three most commonly used qualitative methods are observation, in-depth interviews, and focus groups (Mack, 2005). Each method corresponds to the type of data to be collected. Participant observation is preferred for collecting data on natural behaviours within the usual contexts; in-depth interviews are normally used to collect data on the participants' perspectives and experiences; focus groups are preferred when data on cultural norms of a group are collected (Mack, 2005). The researcher chose participant observation and interviews as the main research methods to collect data about how the learners were interacting in the class where the technology was present and also what their perspectives or opinions were about their learning through the digitised learning resources. Through these data collected, the researcher

could understand how the learners were making sense of the concepts and why they were doing it in such ways. Indeed, the focus was on the process of learning rather than the outcomes of the learning. The sections that follow give a detailed account of the methods and relative instruments that the researcher employed in this study on learners' learning.

4.4.1 Observation

According to Kothari (2004), 'observation is one of the most commonly used research methods' (p. 96). He added that observation is normally developed into a scientific tool when the data is collected for a specific research purpose and the observation is 'systematically planned and recorded' (p. 96). Furthermore, Marshall & Rossman (2006), stated that 'observation is a fundamental and highly important method in all qualitative inquiry' (p. 99). Cohen et al. (2007), stated that the 'distinctive feature of observation as a research process is that it offers the investigator an opportunity to gather 'live' data from naturally occurring social situations' (p. 456). For instance, through observation, the information is obtained from the researcher's direct observation of the subjects within their natural contexts. When observation is used as a method for data collection, it should be structured in such a way that the researcher (observer) observes, listens and records. Marshall and Rossman (2006) confirmed that 'observation entails the systematic noting and recording of events, behaviours, and artefacts (objects) in the social setting chosen for a study' (p. 98).

Observation used as a method to collect data has indeed many advantages. Firstly, 'observation helps in reducing or even eliminating subjective bias when done accurately' (Kothari, 2004, p. 96). Secondly, when the observation research method is used, it records 'live events' – what is presently happening and not complicated by past or future behaviours (Kothari, 2004, p. 96). Thirdly, the observation method is not dependent on respondents' readiness to respond demanding more cooperation from the subjects (Kothari, 2004, p. 96) Kothari (2004) further added that very often this method is chosen when 'the participants of the research are not able to provide verbal reports of their actions, feelings, or attitudes' (p. 96). The researcher chose observation as a research method to collect data on Grade 4 learners' learning through digitised learning resources as

it helped her to capture emotions, feelings and attitudes of the learners during their interaction with the digitised learning resources. Another reason for choosing this method was that Grade 4 learners might not be mature enough to be able to voice their emotions or feelings when they were learning. Thus, recording 'live events' through observation provided the researcher with rich data of the participants' learning within their normal classroom context.

There are two main types of observation, namely participant observation and non-participant observation (Kothari, 2017). Participant observation is the situation when the 'observer is a member of the group he is observing' (Kothari, 2004 p. 96). In participant observation, the observer integrates the group to have better insight into what he is experiencing and observing at the same time. However, in a non-participant observation, the observer is completely detached from the group being observed. In such type of observation, the observer does not interfere and observes within a naturalistic environment without being noticed (McMillan & Schumacher, 2001). The main advantage of non-participant observation is that the data collected is more authentic and representative of real-life situations.

The researcher was a non-participant observer and was not engaged in tasks involving the use of digitised learning resources. The advantage of choosing non-participant observation was that the learners, being the participants, were observed and data was generated from their natural classroom environment.

The researcher sought the help of two professionals to videotape the interactions (as unobtrusively as possible) of the participants. Two dummy cameras were placed in the class two weeks prior the data collection process for the young learners to get used to their presence. After two weeks, students did not even pay attention to the cameras placed in the classroom and this process allowed me to increase the authenticity of the data. The reason for opting to videotape the observation was to ensure that no information was missed out during data collection. As researcher, the videos could be viewed and reviewed several times later. The rich information from the videos allowed me to have a deeper analysis of the phenomenon learning through the learners' behaviours and interactions

within the digital classroom. Alongside the recording, the researcher noted down the main observations in observation schedules. More information about the observation schedules will be given later in this chapter.

Before starting the observation of each participant, a plan of the classroom was drawn. For instance, Figure 4.1 is an illustration of the classroom architecture or plan drawn for the observation of each subject in the research. This classroom architecture allowed me to map out the position of the learner being observed and the positions of the cameras to capture learning. Two cameras were used for the observation. One camera (camera 1) was zoomed on the learner being observed and the other camera (camera 2) covered the whole classroom to capture all the interactions of learner within the classroom. Camera 2 included the participant, his friends, the teacher, the whiteboard and the interactive projector within its frame. Positioning both cameras at specific angles allowed the researcher to have thick data of the learner's learning within the traditional classroom context.

From Figure 4.1, we note that 'Ludy' is the subject or participant, the teacher is standing in front of the class facing the students. The whiteboard is at the back of the teacher and the interactive projector is held above the whiteboard. The observer (the researcher) sat at the teacher's table to record the observations in observation schedules. The camera 1 was positioned in front of the classroom and was zoomed on the learner 'Ludy.' Camera 2 was positioned at the back of the class to capture the whole classroom situation.

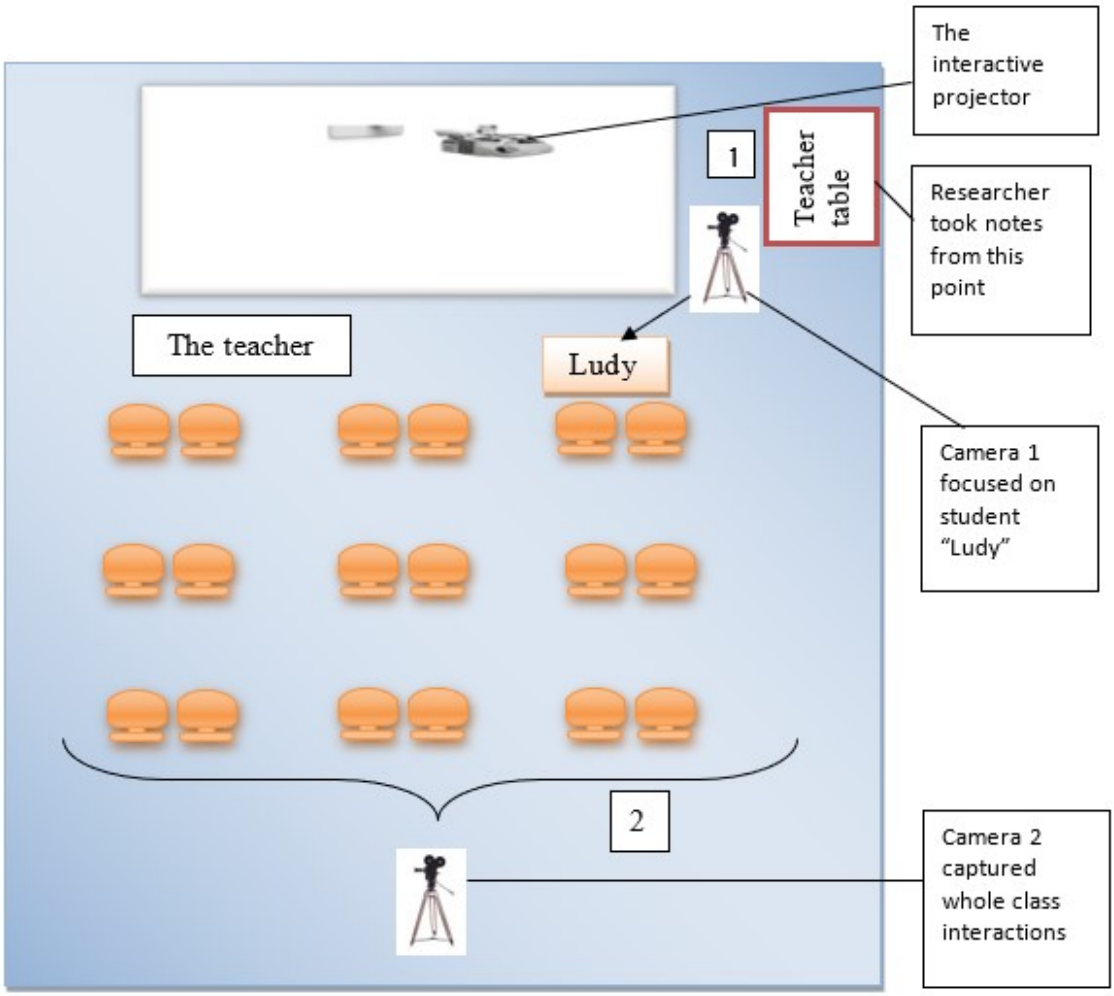


Figure 4.1: An example of a classroom architecture used for observation

Three lessons conducted through the digitised learning resources observed. The topics of the lessons were:

- Air;
- Energy; and
- Objects falling quickly and slowly.

These three lessons were chosen because at the time of data collection, the teachers in both schools were teaching these lessons in line with the syllabus. Moreover, choosing three lessons allowed me to juxtaposed data generated in different settings for textured data that brought about richer insights.

The duration of the lessons was between 20 and 30 minutes depending on the pedagogy that the teacher was using as well as on the digital resource. The sequencing of the lessons was planned according to the timetable of the teacher. The learners were observed in their normal classroom contexts ensuring the recording of both the lessons taught through the IWB and the participants during the class.

4.4.2 Observation schedule

There are two kinds of observation, namely 'structured observation' and 'unstructured observation'. Structured observation takes place when the observation is based on specific structured information prepared prior the observation, whereas unstructured observation is used when the observation is done without any thought prior the observation (Cohen et al., 2007). The researcher opted for structured observation, as a set of criteria had been prepared prior to the observation. This information was included in an observation schedule that guided me to focus observation on specific strands that further assisted me in answering the research questions.

An observation schedule is a form that the researcher prepares prior observing and the form is used to record observations. It carefully stipulates the different categories or behaviours that would be put under the lens during the observation (Coleman, 2019). The observation schedule that the researcher used consisted of items, which were relevant to the research questions and objectives of the study. They were carefully prepared to record observation within the period. The observation schedule was designed to reveal the patterns of the learners' interactions that might be significant to inform learning through digitised learning resources. The observation schedule was filled by the researcher and one schedule was filled for each lesson and for each learner.

There were two sets of observation schedules. An example of the observation schedules is given in Appendix 5. The observation schedule 1 was drafted based on the techno-pedagogical model. This model is the basis for the Sankoré project, more precisely the interactive class in Mauritius. The model has been designed and implemented by members of the CODL, MIE in Mauritius and is

shown in Figure 4.2. The model incorporates the three essential elements of a classroom, learner [L], teacher [T] and resource [R] within a pedagogical triangle. This triangle was used to map out the different relationships among these elements. The learner is put at the apex of the triangle.

Accordingly, using the technology in classroom requires that the interrelationships among the elements function. What exactly has been modelled is how the interrelationships are enacted (Oojorah & Udhin, 2013, p. 3547). The arrows shown of Figure 4.2 indicate the two-way communication, interaction, planning and creation which leads to the dynamic nature of the digital classroom. The teacher and the learner (T-L) communicates through different means to arrive at an understanding of the concepts or even use of the digital resource. In the same digital classroom, the learner interacts with the digital resources (L-R) through the different tools present within the digital resources. The teacher also needs to plan his lessons according to the digital resource (T-R) and sometimes the teacher even creates his own digital resource (Oojorah & Udhin, 2013, p. 3547).. The content in the digital resource aligns with the topics in the curriculum.

The first set of observations were made from the three axes shown in Figure 4.2 to investigate the interrelationships between the teacher, learner and resource within the digital classroom hence informing the researcher how the learners were learning. The observation schedule 1 consisted of a section ‘remarks’ in order not to miss any important information during the observation. Moreover, the observation schedule substantiated the data generated through videos.

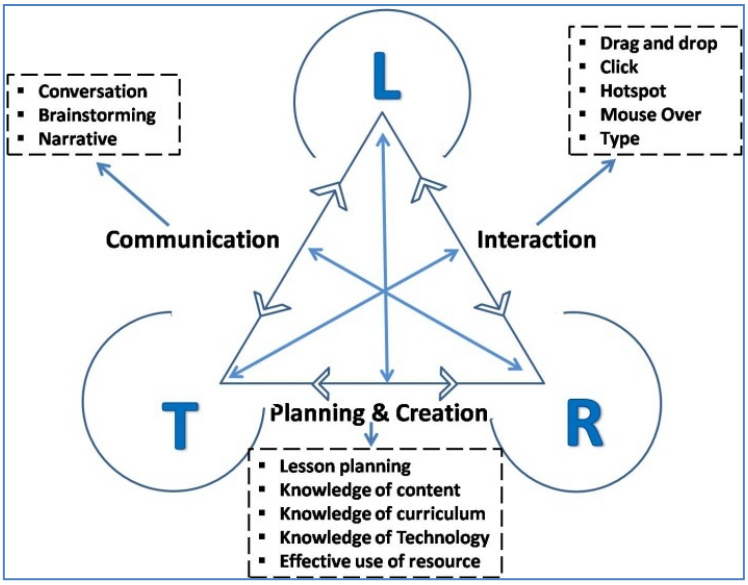


Figure 4.2: The Techno-pedagogical model

Source: Oojorah & Udhin (2013, p. 3547)

The second set of observations was done according to observation schedule 2. Observation schedule 2 was designed based on the constructs of Bloom's taxonomy (1956) (discussed in Chapter 2). The focus was on the three domains of learning namely the cognitive, affective and psychomotor. Moreover, the observations were rated according to a scale ranging from 'very poor' to 'very good'. Attached is a copy of the observation schedule 2 in Appendix 5 with detailed explanations of the different rating scales within the schedule. The rationale behind choosing Bloom's taxonomy as a construct to analyse learning was to arrive at a holistic understanding of how the learners were learning through digitised learning resources. In addition, since one of the criteria for selection of the participants was level of learner, it resonated with Bloom's arguments that learning happens according to different levels or taxonomies.

4.4.3 Semi-structured interviews

Another research method that was used was the interview. Kvale (1996) stated 'an interview is an interchange of views between two or more people' (Cohen et al., 2007, p. 368). He added that the exchange should be on a topic of mutual interest to both parties and is focused on the objectives of the research. Lain (1967) posited that 'an interview is not solely subjective or objective, it is rather

intersubjective' (Cohen et al., 2007, p. 368). Through interviews, the subjects are able to discuss their own interpretations of the world and express their opinions. 'The interview is a flexible tool for data collection' (Cohen et al., 2007, p. 368). 'Using interview method for data collection involves presentation of oral-verbal stimuli' (Kothari, 2004, p. 97). According to King, Horrocks and Brooks (2018), an interview consists of a series of questions that the interviewer asks to get clarity about a phenomenon. The interview is a valuable tool as it allows the interviewees to share their beliefs, opinions and attitudes within their own contexts (McMillan & Schumacher, 2001). Moreover, during an interview, the interviewer has control over the sequencing of the questions, leaving space for spontaneity. Cohen et al. (2007) argued that 'the interview is a powerful method' but at the same time the researcher should be aware that it can be time consuming and 'opened to interviewer's bias' (p. 368).

The researcher will explain the three most common types of interviews, namely unstructured, structured and semi-structured interviews. In an unstructured interview, the interviewer does not start the interview with predetermined questions. It is a flexible method of interview and the interviewer can ask questions in the order of preference. The main problem with this type of interview is comparability. It becomes tedious to compare the responses of one participant against another participant's responses. However, a structured interviews follows a more rigid schedule of questions to ask during the interview (Cohen et al., 2007). It involves pre-set questions prior the interview and it is time consuming. The problem with the structured interview method is that it is sometimes too rigid and the interviewer might miss important information that does not form part of the interview questions. Semi-structured interviews lie in between structured and unstructured interviews. The interviewer prepares a list of questions prior the interview but allow a degree of flexibility to the respondent to answer the questions set. Sub-questions are often formulated to assist the participants in answering the interview questions. However, one thing which is common in all the three types of interviews mentioned above is that the main objective of all the three is to provide information to answer the critical questions.

The researcher used semi-structured interviews as the research method for data collection purposes and the informants were able to openly voice out their opinions about their learning of the concepts through the digitised resources. During the semi-structured interview, there were fruitful conversations between the researcher and the participant regarding their learning. Deep and rich responses about how the learners were learning and why they were learning in such ways, emanated from the semi-structured interviews.

The questions set acted as a roadmap for the interview but eventually many other questions arose during the process to probe further into the phenomenon. All the questions set were geared towards answering the research questions. The interviews were based on drawings produced by the learners. The drawings showcased their learning. More information about the drawings is given in Section 4.4.6. The reason behind conducting the interview in parallel with the drawing activity was to set questions that would allow me to probe into the representations of the learners' learning in the drawings. More information on the children drawings will be given later in Section 4.4.6 of this chapter.

It is crucial to look at the world from the children's perspectives rather than those of an adult. According to Arksey and Knight (1999), children have different cognitive and linguistic development and they have a lower level of maturity than adults in answering questions (p. 116). Using the semi-structured interviews allowed rephrasing of questions to facilitate the learners of eight to nine years old to answer the questions. The researcher chose to combine the semi-structured interview method and the drawing activity to allow the children to give me authentic and trustworthy information about their learning. Moreover, the researcher prepared a sample introductory statement before conducting the interview. An example of the sample introductory statement is shown in Appendix 7. The reason behind drafting the sample introductory statement was to make the respondents (learners of eight to nine years old) feel at ease. It also helped me to establish trust with the children and to make the interview 'non-threatening' (Cohen et al., 2007 p. 393). It is noted that the researcher had to use creole, the first language, to address a few learners to build rapport with them.

After the semi-structured interview, all the participants were grouped together and a group interview was conducted. The reason for conducting the group interview after the semi-structured interviews was to encourage interactions among peers. Cohen et al. (2007) argued that 'group interviews might be less intimidating than individual interviews' (p. 374). Eder and Fingerson (2003) stated that the 'power and status dynamic is largely involved in interviewing children' (Cohen et al., 2007, p. 374). The researcher had to ensure that the children were given a voice and were put in a setting where they were comfortable (Mayall, 1999). Prior to the interview, guidelines were set to ensure the smooth running of the group interview process and these sessions were moderated so that everyone had the opportunity to speak and not only one student dominated the session. The same introductory statement and the same interview schedule used for the individual interviews were used for the group interview. However, there was a greater degree of flexibility with regard to the group interview and thus there were more dynamics in the group interview. The next section explains how the interview schedule was prepared and piloted for refinement.

4.4.4 The interview schedule

As mentioned earlier, interview schedules were used as tools to collect information during the interview. Alongside, the interviews were also audiotaped to ensure richness of information. The audios helped in transcribing the interviews to enhance the trustworthiness of the data. Designing the interview schedules entailed translating 'the research objectives into questions that will form the main frame of the interview schedule' (Cohen et al., 2007 p. 375). The questions in the interview schedule precisely reflected the research phenomenon. Firstly, the variables had to be specified and this was done using the three research questions stated in Chapter 1 of this thesis. Besides the objective of the study, the researcher had to consider the age the participants being children of eight to nine years old and how depth would be sought. The researcher chose to use both open-ended and closed questions. Open-ended questions are free-form questions that allow the subjects to respond in detail based on their feelings, emotions or beliefs. On the other hand, closed-ended questions are restricted to limited options. Unlike open-ended questions, closed-

ended question do not allow the interviewer to investigate deeper into the respondents' replies (Cohen et al., 2007 p. 375). The answers are often limited to a 'yes' or 'no' answer. The researcher chose to start with simple questions and then move to higher-order questions, which required more reflections. The open-ended questions followed the closed questions to allow the respondents to justify their responses where required. Other sub-questions were used to probe further into learning through digitised resources during the interviews as and when required.

4.4.5 Piloting the observation and interview schedules

The purpose of doing the pilot study was to refine the instruments used for the generation of data. The pilot study was conducted on learners' learning digital resource entitled 'Body cover' in a Grade 4 class. The reason for choosing this topic was because it was a new topic for the learners. Besides, the school chosen for the pilot study was not among the schools chosen in the samples for the study. The teacher was made aware of the ethical considerations that were part of the research. Consent forms were distributed to parents concerned. A sample of five students was selected. The class was observed for 30 minutes.

During the observation, the students could relate what they were seeing in the resources with their experiences and answer the questions. These observations tallied with the constructs written in the observation schedules. However, while interviewing the students on their learning through digitised learning resources, many of them had difficulty in explaining what they had actually learnt. Hence, the interview schedule was redesigned to allow more flexibility through the questions hence facilitating learners' responses. The focus was redirected towards the three research questions related to the study.

4.4.6 Visual Methods

Visual methods are becoming very common in social research nowadays and they 'allow the researcher to unfold more layers of meaning, thus increasing the richness and validity of the data' (Glaw, Inder, Kable & Hazelton, 2017, p. 1). Using 'visual methods help in enhancing the trustworthiness of the findings through member checking' (Glaw, Inder, Kable & Hazelton, 2017, p. 1).

Since children are naïve and unlikely to give a true picture of their thinking through interviews, the researcher decided to ask students to draw what they had understood on topics taught. This activity was carried out after observing the lessons that involved the use of digitised learning resources. The drawings helped to produce authentic data and children were able to express themselves more freely. The drawings were used as a primary source of data to analyse the process of learning as learners were engaged in the use of digitised learning resources. The researcher asked learners questions based on their drawings to confirm the data obtained from other sources and also for triangulation. After the lesson, all the students were given an activity to represent their understanding of the concepts through drawings. For ethical reasons, all the students were chosen to ensure that the self-esteem of all learners was respected.

Here also, before conducting interviews, the researcher made use of an introductory statement to gain the trust and confidence of the learners. The researcher began by narrating her own story to the children using drawings. The researcher felt it necessary to explain to the learners that all people can share their stories through drawings or other visuals. Then sheets of paper were distributed with empty grids and provided pencils and coloured pencils to the learners. According to Young and Barrett (2001), children can better express themselves through drawings. The choice of using coloured pencils was to make the activity more enjoyable. Yuen (2004) and Driessnack (2006) also agreed that drawing inspires children to describe sensitive issues and a revelation of their emotions and experiences. The researcher then asked them to draw what they had just learnt. While the learners were drawing, they were encouraged them to write the key words or sentences to encapsulate the gist of what the drawings represented.

The students represented their understanding of the concepts in a very creative and fun way. They created their own comic strips in the templates provided to them (Appendix 8). The drawings were chronological and sequential. This helped in analysing how the students were making sense of the information from the beginning to the end of the class.

When the participants had completed their drawings, a semi-structured interview was carried out with the participants to gauge their learning through the digitised learning resources from their drawings. The semi-structured schedule explained in the previous section was used to conduct the interviews based on the drawings. The language used was French/Creole as this was the medium of communication that was mostly used in these Mauritian primary schools. It helped in increasing the ease of the participant to communicate and managing power relations. The researcher referred to the drawings and the written narration to facilitate the semi-structured interviews with the children. Findings from other research revealed that children converse better when they are given the opportunity to draw earlier (Driessnack, 2006). The rationale behind using visual methods was to reduce the interference of the researcher and to increase the authenticity of the data as they were child-led. The researcher was able to elicit greater clarity by asking the participants to elaborate further. The next section describes how the grids were refined when they were administered on a group of learners during a pilot study.

4.4.7 Piloting the grids used for the drawing activity

A second phase of the pilot study was to test the grids that were prepared to capture data on how the learners were learning through the digitised learning resources. After observation of the drawing activity, it was concluded that few students were having difficulties to represent their learning through drawings in the four grids (Figure 4.3). The main problem that the researcher encountered was the notion of chronology. Their drawings were meaningful when they were answering to the questions from the interview but they could not sequence the events in their representations. Two students started to draw in the last grid. Another student told me that he did not have anything to draw in the last grid. He told me: 'It was too much.' Therefore, the researcher took the decision to reduce the grids to only three and also numbered them 1, 2 and 3 (Appendix 8). In that regard, the researcher decided to enhance the instructional design of the grid by numbering each grid and to limit the number of grids to three to facilitate the drawing and interview process. Below is an example of the grid that was first

given to the student for the drawing activity during the pilot study (Figure 4.3) and the reworked grid used during the research is found in Appendix 8.

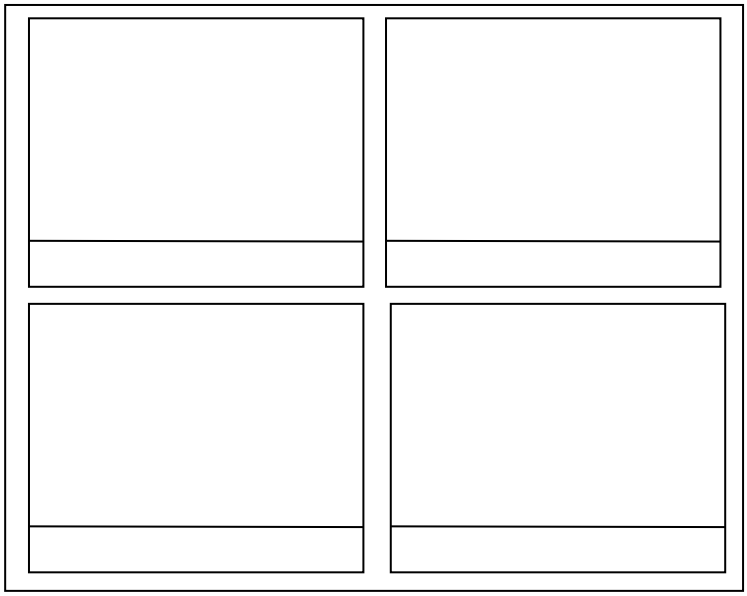


Figure 4.3: Grid used during pilot phase

4.4.8 Researcher's reflective journals

Etherington (2004) stated that 'keeping a reflective journal is very famous in qualitative research and the purposes of keeping reflective journal is to use reflections as a major part of the research process' (Ortlipp, 2008, p. 695-696). The researcher kept a reflective journal to record and reflect on the observations. The reflective journal supported the exploration and analysis of different patterns that might have occurred in the learners' learning through digitised learning resources. Recording in the reflective journal also allowed the researcher to enhance awareness of the events occurring during the learning process, may it be the learner-learner interactions, the teacher-learner communication or the learner-resource interactions. The reflective journal also helped the researcher to note details of interactions beyond the narrow video lens and facilitating the analysis of learners' learning through the digitised learning resources in more depth. An example of the guidelines for recording in the reflective journal is found in the Appendix 9. The guidelines helped the researcher to structure the reflections in order to arrive at a deeper analysis of learners' learning. The

researcher used the reflective journals after the observations and interviews were conducted to be able to better reflect on the events.

4.4.9 Sequencing the techniques/methods

The data was gathered using the different techniques or methods explained earlier in this chapter. Table 4.1 below illustrates the sequencing of the techniques:

Table 4.1: Sequencing the techniques

Method	Features	Purpose	When [time frame]	Details
Initial observation	Extended period of contact as helper and observer Requested teacher to suggest lessons that would best suit the scheme of work for the term	Become familiar with setting and local meanings; become a familiar presence in setting; gain confidence of participants To increase the level of involvement of the teacher	Before lesson	Teachers and learners were prepared for the conventions in the study. For example, dummy cameras were set few days before the observation for the learners to get used to the device, thus reducing interferences The positionality of the researcher was reviewed by building rapport with the teacher thereby reducing observer's bias or interference The researcher used to chat informally with all the students

Method	Features	Purpose	When [time frame]	Details
				irrespective of those from the sample to make them feel at ease with the researcher's presence in the class The researcher worked in close collaboration with the teacher for the digitised learning resources to be selected for the observation. The topics in the digitised learning resources chosen were in line with the syllabus for the second term
Drawing of classroom architecture	The map of the classroom and the seating arrangement of the participant(s) Drawing of positioning of camera	To situate the position of participants and cameras	Before the lesson	The cameras were placed at strategic places within the classroom to capture rich data

Method	Features	Purpose	When [time frame]	Details
Video-recording with audio	Two Cameras in the class Precise record of naturally occurring interactions as per the observation schedule	One focused on the student and the other one having an overall picture of the class The cameras helped the researcher to capture rich data on the interaction/learning of the participant	During the lesson	The main challenge was to ensure that the recordings were done correctly and to take the notes at the same time Two professionals helped the researcher with video-recording while the researcher concentrated on noting down the observations in the observation schedules
Observation schedules	Memo-like, details of interaction beyond narrow video lens	The written notes were in line with the objectives of the study, thus helping me to understand complexities and dynamics of interaction processes	During the lesson	
Reflective journals	Notes of the events were kept in a reflective journal by the	This helped the researcher to reflect on what happened during the data collection.	After the lesson	Going back to the notes allowed the researcher to gauge the progress of the research in terms of data collection as well

Method	Features	Purpose	When [time frame]	Details
	researcher after each visit	Document development of study and subjective values; reflect on field notes		as progress as a researcher in terms of reflection on learners' learning
Visual Methods (Drawings)	The students were set in groups. Grids were provided to all the students in the class	The grid was provided in order for the students to sequence their learning All students were asked to participate in the activity for ethical reasons and also not to break the self-esteem of students who were not part of the sample	After the lesson	The sequencing of ideas in the grid helped the researcher to better understand how the learners were making sense of the concepts they learnt in the lesson and thus help the researcher to answer the research questions
Semi-structured Interviews	Semi-structured (individual and group interviews)	Gain insights into different perspectives over time; record consistencies or inconsistencies in participants' views	After the lesson	Interview done after the drawing activity in order to confirm the data and for triangulation

4.5 Section 3: Procedure for analysing the data

This section describes the procedures undertaken to analyse the findings. The analysis was done in three levels and Table 4.2 provides an outline of the three levels of analysis.

Table 4.2: The three levels of analysis (analytical framework)

Level of analysis	Details
Level 1: Creating stories about learning	Transcription of videos, interviews
	Creating the data set
	Translation of the transcriptions
	Colour coding of the transcripts
	Extracting initial themes and sub-themes
	Clustering data under the themes and sub-themes for each participant
	Writing of stories
Levels 2: Analysing themes on learning	Analysing themes on learning at semantic level drawing initial conclusions
Level 3: Analysing learning through digitised learning resources	Analysis at latent level (against LR and TF), drawing conclusions and answering research questions 1 and 2

4.5.1 Level 1 analysis: Creating stories about learning

This section details the procedures used in the first level analysis of the data.

4.5.1.1 Transcribing the interviews and coding of the observation notes

Once the fieldwork was over, the author had a large volume of data and had to make a decision on how to organise the data. According to Cohen et al. (2007),

analysing qualitative data includes ‘organizing, accounting for an explanation of the data’ (p. 461). They added that qualitative data analysis, involves ‘making sense of data and noting patterns, themes, categories and regularities’ (Cohen et al., 2007, p. 461). Cohen et al. (2007) also stated that there is ‘no restricted route to analyse and present qualitative data but the researcher should adhere by the issue of fitness for purpose’ (p. 461). ‘By binding with the principle of fitness for purpose, clarity should be present as to what kind of analysis is undertaken’ (Cohen et al. 2007, p. 461).

From the first level, the first stage was to transcribe data obtained from videos and audio recordings to be able to make sense of the data from the field. While transcription might be considered as a simple exercise of transforming verbal conversations into written form, the researcher had to take a decision of whether to translate or transcribe the data or both. Finally, the choice was made to do both transcription and translation. The reason for translating the transcripts was to cater for readers who were not conversant with the Mauritian Kreol as children conversed in French or Creole language during the interviews and observations.

Furthermore, the researcher listened to the videos and audios several times and immersed into transcribing the data first. Very often, we view ‘transcription as an easy and straightforward technical task but in fact, it is very a meticulous task as it involves judgement and interpretation’ (Bailey, 2008 p. 127) and how to best represent the data. The researcher transcribed the data obtained from the observation and the interviews for all the 12 participants. The researcher had to go back to the raw data several times to make sure it accurately transcribed the rich data and described all the occurrences in detail.

According to FitzGerald (2012), ‘video captured *in situ* involves rich information and reveals important incidents that are linked to the interactions’ (p. 2). There are a variety of tools that might assist in analysing video but the researcher did it manually by pausing the video at very short intervals and writing out everything that was observed. This process allowed the capturing of actions, emotions, attitudes and behaviours of the learners. It was indeed very time consuming but allowed me to obtain rich information. Two peers did the member checking and

vetted the transcriptions for both the videos and the interviews and few things were amended; for example, a few emotions that the learners depicted in the videos were described in greater depth in the video transcriptions. The member checking helped me to ensure trustworthiness and authenticity of the transcriptions.

After all the data was transcribed, the researcher reviewed all the transcriptions and produced a data set. The researcher chose to omit five participants from the sample. In Sandy Government School, Kanen was removed from the sample as he was not able to answer the questions during the interview and his interview consisted of only yes/ no answers. He could not actually justify the choices made in his drawings. In the same school, Riyaad was also removed from the study, as his data was very similar to that of his friends and would not have added to the richness of the data. Moreover, from Violet Government School, Mohammed, Nishi and Wendy were not considered in the study. Data from Mohammed was not taken into account because out of the three lessons, he was present for only one lesson and this led to limited data. Nishi's data resonated with other participants' data and it was decided to omit Nishi's data from the sample and this did not affect the data. In the case of Wendy, as for Kanen, there were many instances when she could not elaborate her responses. To summarise, seven participants were considered, four from Sandy Government School and three from Violet Government School. A copy of the data set is attached in Appendix 11.

4.5.1.2 Writing of the stories

Once the transcripts were produced, the researcher made the decision to create stories of each participant out of the data collected, and this constituted the first level of analysis. Over a factual rendering of the findings, the researcher chose to create 'stories' to better foreground the emotions, attitudes and behaviours of the learners who were children of eight to nine years old and this was considered the 'fitness for purpose'. In linguistic form, stories are considered the best suited to express human experience as lived (Ricoeur, 1991). Thus, the researcher used stories to capture the human experience and connectedness between the

digitised learning resources, the teacher, and the learner within the digitised classroom (Ricoeur, 1992). Moreover, since the study was conducted with primary school learners of eight to nine years old, the researcher wanted to recreate the learning experiences of the children while retaining flavours of the setting and classroom interactions. Stories also allowed the researcher to better foreground the voices of the participants and the learners' naïveté during their learning of the concepts through digitised learning resources. Representing the social structure and the learners' human activities while learning was made easier through stories (Kamberelis, 1999 p. 406). The researcher followed and adapted Braun & Clarke's (2006), six-phase framework of thematic analysis to write the stories (Maguire & Delahunt 2017, p. 3354). Table 4.3 illustrates the steps used to generate the initial codes to be able to write the stories.

Table 4.3: Six-phase framework for doing thematic analysis (Braun & Clarke, 2006)

Step	Details
1	Become familiar with the data
2	Generate initial codes
3	Search for themes
4	Review themes
5	Define themes
6	Write up

Step 1: Becoming familiar with the data

The researcher read the transcripts various times to become familiar with the data of each participant gathered from multiple sources. Notes were taken of the main impressions.

Step 2: Generate initial codes

Then, the researcher began to organise the data in a systematic manner. The researcher used colour coding to generate initial codes relating to the phenomenon, learning, from the transcripts of each learner. The researcher did not code each line in the transcripts but only those that shed light on learning.

Step 3: Search for themes

A theme in qualitative analysis is 'a pattern that captures something significant or interesting about the data and/or research question' (Maguire & Delahunt 2017, p. 3356). According to Braun & Clarke (2006) and Maguire & Delahunt (2017, p. 3356) , 'there are no cast-iron rules about what makes a theme'. Based on the colour-coded data, and using an inductive approach, the researcher identified four preliminary themes: (1) learning with understanding (2) learning with different styles (3) learning in context and (4) critical reflection during learning. These main themes were further divided into sub-themes or categories to allow me to probe deeper into the layered data for a better understanding of the phenomenon. The themes and sub-themes were determined due to their prevalence across the experiences of all participants and the fact that they allowed me to capture important details about the phenomenon in relation to the research questions. Table 4.4 is the thematic map of the initial themes and sub-themes derived from the raw data and used to construct the stories.

Table 4.4: Thematic map (themes and sub-themes)

Theme: Critical Reflection during learning Code: **Sub-theme: Emotional Response to Learning**	**Theme: Learning with different learning styles** Code: **Sub-theme: cognitive abilities to recall (Cognitivism)**	Theme: Learning with understanding	**Theme: Learning in context** Code: **Sub-theme: Learning through diversity of experiences** Code:

(Enactivism)			**Sub-theme: Learning through interactions with peers.**

Step 4: Review themes

In this phase, the researcher mapped out the transcripts according to the themes identified. The researcher re-assessed whether the themes really reflected the data and whether there were other sub-themes. The colour coding done before facilitated the work of transposing the data from the transcripts to the respective themes. The codes indicated in Table 4.4 refer to data from the transcripts that were clustered under identified preliminary themes. An extract of a filled thematic map for a participant is shown in Appendix 12.

Step 5: Define themes

In this step, a thematic map was created by trying to sequence the ideas in a chronological manner to be able to organise writing of the stories. A thematic map was drawn for each participant according to the data.

Step 6: Writing of stories

Following the steps above, the researcher now started the journey as a storyteller or a storywriter. The composition of the stories was very complex, as the researcher had to make sense of data obtained from different sources and construct stories that could best capture the learners' experiences of learning (being the phenomenon of the study). Through the stories, the researcher was able to structure the plots that were closely based on the learners' learning through the digitised learning resources in a unified episode (Hatch & Wisniewski, 1995, p. 7).

Indeed, this was not an easy task, as the researcher considered as being in the mind of the children to be able to write the stories from their perspectives. The researcher had many versions of stories before the researcher finally came to

stories that could best represent the learning of the participants through the digitised learning resources. Writing children's stories required vibrant and rich imagination to enable readers to get an insight into the learning through digitised learning resources within the Mauritian Grade 4 classroom context. The researcher had to bring all these factors together in a creative way.

One challenge encountered was when the researcher had to use the language children actually use to converse. The researcher drew back from childhood memory as stimulus to write the stories in a language which was adapted to children of eight to nine years old. The researcher had to be imaginative and at the same time remain true to the data to construct the children's stories. The researcher was inspired by children's bedtime story books regarding the language, tone and ways of telling the stories. For instance, Figure 4.4 below is a collage of the books consulted to construct stories.

Figure 4.4: Collage of storybooks consulted to write stories

Though the researcher consulted the books to get a sense of the writing process, the central focus remained to arrive at an understanding of how each learner was learning through the digitised learning stories and the researcher had to foreground the phenomenon within the stories.

The different storybooks that the researcher consulted were written using different points of view. The researcher looked at the findings again and then decided to use the first person and the third person to narrate the stories. The choice of the stance adopted was made in connection to the nature of the data

within the context. For each narrative, a rationale was given for the way the story was told. For example, if the learner was someone who learnt mostly through peer interaction, the setting, or 'exposition' reflected this characteristic of the learner. When readers are reading a story, they often ask: 'Who is narrating the story?' This is called the point of view in which the story is told. 'Point of view refers to the narrative voice through which the story's plot unfolds and the reader can experience the story' (Diasamidze, 2014). The choice of the point of view can be the first, second or third person.

In this thesis, the choice of person was also made in relation to the themes that emerged. The most dominant characteristics were used about the learner's learning in the themes and the researcher decided to use the first person or third person to better foreground the phenomenon of learning. When the story was told using the first person, the researcher wrote it exactly the same way it would be told to peers. The researcher chose to write in the first person when the learner was able to talk about his or her learning in detail and with emotions. Using the first person displayed the actual learning taking place within the classroom context in the child's voice. The choice of voice represents the consciousness through which the story is being filtered. When the voice is of the child ('I'), a childlike voice emanates.

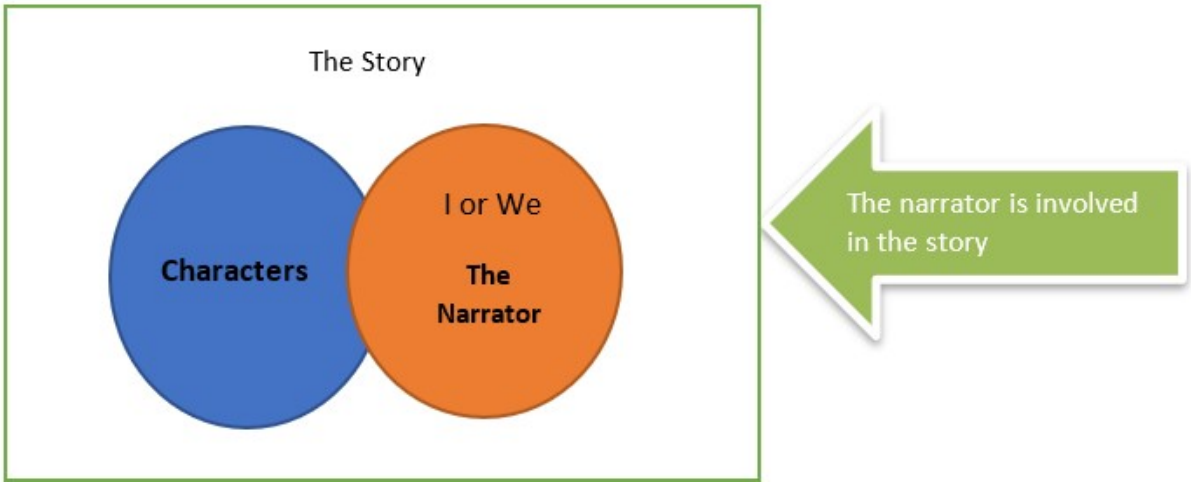


Figure 4.5: First person narration

Using the third person, the researcher acted as the outside observer telling the participant's story. The researcher acted as the 'objective third person' or at times

'limited third person' as the story was constructed telling about how the learner learnt. Being the 'objective third person,' the story was told following the participants' interactions and dialogues. When the story was told using the 'limited third person,' the story was written from the character's voice. When the third person is used, the researcher actually tells the story, so it is filtered through the researcher's consciousness. The researcher was able to describe the different factors influencing the learners' learning through digitised resources.

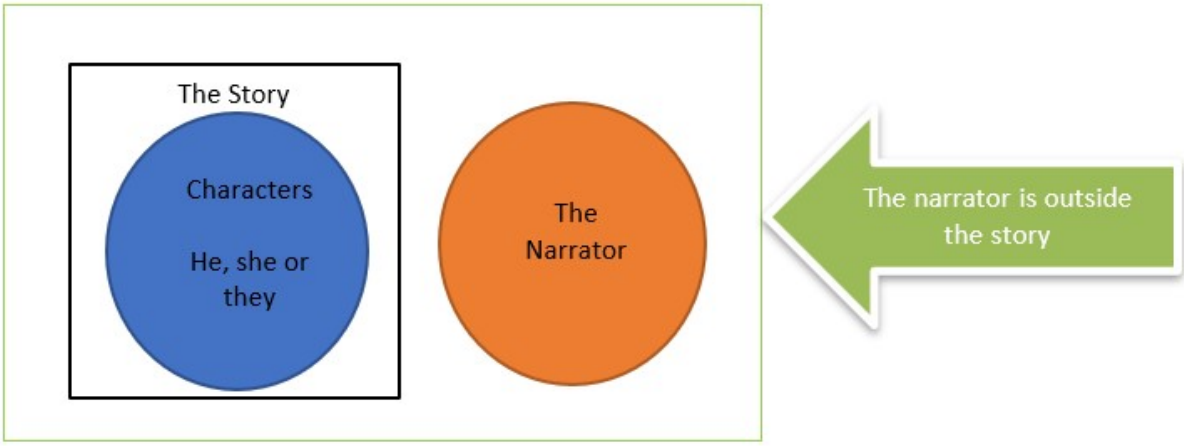


Figure 4.6: Third-person narration

The story and the plots were two ways to structure the stories in this thesis. Both the story and plots were presented in terms of the learners' lived experiences of learning through digitised learning resources. These learning experiences through digitised resources were often influenced by different occurrences in the digital classroom. These influences took many forms, be it emotional, interpersonal, and intrapersonal or interaction between the learners and their context. To describe the story, the researcher asked several questions: Where is the story set? Who are the main characters? What happens to the learners when they face the challenges? How do the learners learn within this context? The researcher represented stylistics features of the interactions by writing the words or conversations in the short stories in Italics. However, to establish the plot structure of the stories, the Freytag's pyramid (Mou, Jeng, & Chen, 2013, p. 1035) which is presented in Figure 4.7 was used.

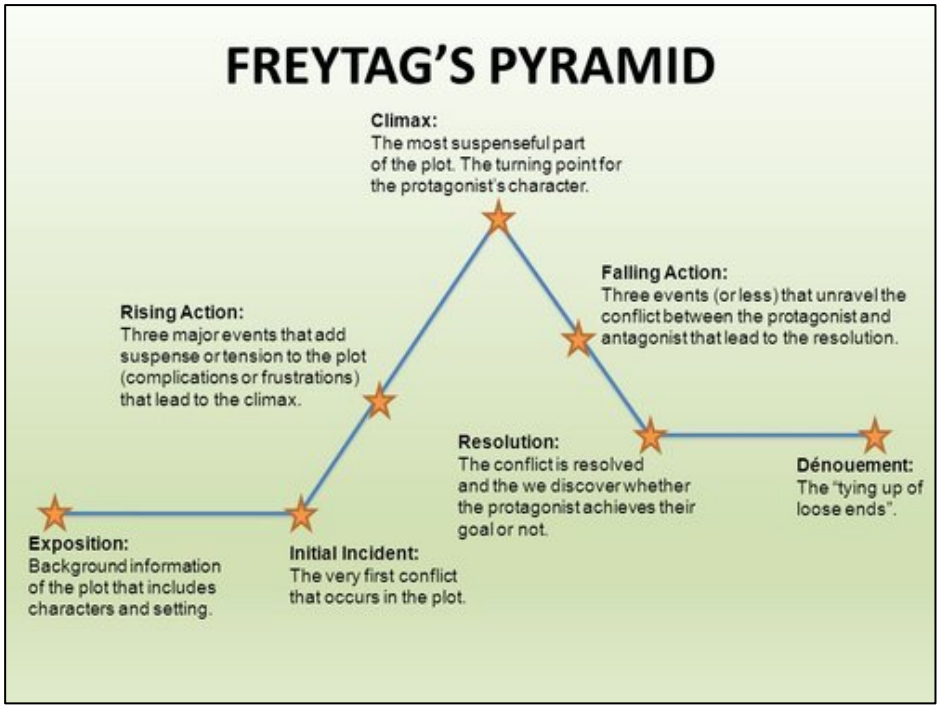


Figure 4.7: The Freytag's Pyramid

Source: Landborough (2017)

The Freytag's pyramid consists of a seven-act structure:

1. Exposition;
2. Initial incident;
3. Rising Action;
4. Climax;
5. Falling Action;
6. Resolution; and
7. Dénouement.

The researcher applied the five-act structure of the Freytag's pyramid to construct the stories as follows:

Exposition: The researcher presented important background information to set up the story. Details about the learner who is the main character and the setting that is the digitised classroom were provided.

Initial incident: The researcher then presented the first incident that happened in the short story, often called as the trailer of a movie.

Rising Action: From the data, the researcher presented the occurrences that lead to the climax of the stories. Events were created that allowed the reader to visualise what actually happened in the digitised classroom and how the learners were learning through the digitised learning resources. The intention was to provide a real representation of the situation. Here, the researcher created a scenario so that the story pivoted around the critical incident which impacted on the learning process. This is where the learner reacted to the situations or issues where the conflicts between the learning, the pedagogy, the context and the digitised learning resource increased.

Climax: In the stories, the climax was presented through the data obtained from the different sources. The observations, interviews and drawings revealed a lot about how the learners were actually learning through the digital resources and also the extent to which the learners' learnt the concepts. Here the reader could get a better grip of the phenomenon within the Mauritian digital classroom.

Falling Action: The falling action comprised the learners justifying their choice of learning in such ways.

Resolution: After the falling action, the researcher narrated the final goal which was learning through digitised resources. Learners' drawings were displayed in the short stories to support the narration.

Dénouement: The dénouement provided a conclusion to the stories. The endings were closed in all the short stories. Nevertheless, there were cases when the short stories were concluded but there were still scope for further reflections on the learner's learning.

However, the greatest challenge was to create an engaging opening that would interest the reader and set the tone of the story. Another challenge was to find an appropriate title to reflect the essence of the story. However, after writing several versions of the short stories, the titles were reworked to better reflect the learner's learning through digitised resources within the story.

4.5.2 Level 2 analysis: Analysing themes on learning

Following the construction of creative stories, the researcher embarked upon another level of analysis. This second level of analysis moved from a descriptive level to a more interpretive level. In the first stage of analysis, preliminary themes emerged and were used as backbone to create the stories. The second level of analysis was to move to higher levels of abstraction.

Another decision that was taken was whether the themes had to be analysed at a semantic level (explicit level) or latent level (interpretative level) (Braun & Clarke, 2006 p. 13). At a semantic level, the researcher analysis is limited to only the data collected from the participant. There is a progression from organising the data (to show patterns) to interpreting those (Braun & Clarke, 2006). According to Patton (1990) and Braun & Clarke, (2006 p. 13), the patterns can be theorised, leading to broader meanings (However, 'thematic analysis at latent level involves going beyond the semantic content and begins to scrutinise the underlying ideas, assumptions and conceptualisations'. Braun & Clarke (2006, p. 13). The latent level analysis informs the semantic content of the data. Regarding the study, the researcher first used the semantic level analysis to interpret the patterns of interactions but then moved to a latent level as the researcher sought to examine underlying assumptions and conceptualisations of learning. Hence, the stories were used as an opening to a latent level analysis.

4.5.2.1 Celebrating the themes (at semantic level)

According to Braun and Clarke (2006), 'thematic analysis refers to the method for identifying, analysing and reporting patterns (themes) within data' (p. 6). As for Taylor and Bogdan (1989) and Aronson (1995, p. 3), 'themes are defined as units derived from patterns'. Leininger (1985) and Aronson (1995, p. 3). It was agreed that 'when ideas and experiences are clustered together to bring meaning, they are called themes' and Constas (1992) also restates, 'an interpretative approach should be considered to derive the themes from origin'. Thus through themes, patterns emerged. The next step was to support the themes according to valid arguments (Aroson 1995 p. 3) and this is what is referred to as 'thematic analysis' in the thesis. A line-by-line analysis was done

and the themes were supported by extracts from the stories of each participant. The goal was to verify and reduce omitting important categories from the stories, thereby ensuring grounding of the themes extracted from the data.

4.5.3 Level 3 Analysis: Analysing learning through digitised learning resources (at latent level)

To be able to make sense of the themes, the researcher had to analyse them through a specific lens. The researcher chose to analyse learning through digitised learning resources using 'metamodernism' as the theoretical framework. Constructs of 'metmodernism' were the significant building blocks of the analytical framework. The stories of each participant were constructed based on interactions of the learners in the digital classroom in Mauritius. However, the stories were just representations of the learning and thus to discuss the phenomenon, the researcher had to analyse the content of the stories in more depth. The researcher first thought of using content analysis, which is an approach to analyse text, moving from intuitive to systematic analysis (Mayring, 2014). However, the problem with that method was that it pre-supposes the themes prior to presenting the data that is it pre-empts the themes before me even writing the stories. Moreover, it was not totally in line with the paradigm used, which was interpretivist. Thus, the stories were not analysed with the themes already in mind. It was the stories that revealed the themes and these themes had to be interpreted under the research lenses linked with the literature review and the theoretical framework. It also helped in answering the research questions 1 and 2 as to what the learners were learning and how they were learning through the digitised learning resources. The level 3 stage allowed the researcher to move to a higher level of abstraction. Drawing from the conclusions, the researcher examined the underlying conceptualisations of learning in the metamodern era.

Finally, the thesis building allowed the researcher to bring methodological and conceptual reflections in line of learning in the metamodern era. The researcher also added personal and professional reflections with regard to learning of children of eight to nine years old through digitised learning resources. The analysis on learning also brought scholarly contributions to the body of

knowledge on conceptualisations of learning in the metamodern era and possibilities for further studies. The next section details the ethical considerations taken care of during the research.

4.6 Section 4: Ethical considerations

In research, ethical issues normally arise, especially when researching vulnerable people from the society (Flewitt, 2005). It is very important that we preserve what participants share with us in order during the research (Flewitt, 2005). In this study, ethical considerations were at the core since the participants were learners of eight to nine years old (underage learners); several strategies were used for that purpose.

At First, the University gave the ethical clearance to conduct the study with primary school learners of Grade 4. Please refer to Appendix 1.

Secondly, permission was sought from the School's Authority which is the Ministry of Education, Tertiary Education, Science and Technology before accessing the selected schools for data collection. Please refer to Appendix 2 for the letter certifying access to the schools granted. To preserve the confidentiality of data, the actual names of the schools are not revealed in the letter shown in the Appendix 2.

Thirdly, informed consent forms were prepared to obtain ethical clearance from parents in order for their children to participate in the research (Appendix 3). The informed consent forms consisted of a brief of the research's aims and objectives and how the anonymity of participants would be preserved. Moreover, details about the procedures used to collect data were outlined in the consent forms. The consent forms were given to the parents/guardian of six learners from Sandy Government School and six learners from Violet Government School who agreed to participate in the research, prior to data collection. Informed consent forms duly signed by the parents/guardian were then collected. One parent even phoned me for additional information regarding the study. The parents or responsible parties were also apprised of the fact that their child would not be harmed in the research under any circumstances during the research.

Fourthly, the teachers of the selected Grade 4 classes for both schools were also asked to sign a consent form to signal their agreement to be part of the research (Appendix 4). The researcher presented the research proposal to them, emphasising the objectives and how the research would be beneficial to different stakeholders in multiple ways. They were reassured that the data would remain confidential and would not harm them in any way. A work schedule was drafted in collaboration with the teachers.

Then, the researcher's positionality was renegotiated as researcher before embarking on data collection. Two weeks before data collection, the researcher started to build rapport with the teachers and the learners by engaging in informal talks. After two weeks, the researcher was able to start the data collection with minimised interferences.

Lastly, pseudonyms were used to refer to the participants and schools in the study. The reason for using pseudonyms was to preserve the anonymity of the participants and schools. The pseudonyms used are shown in Table 4.5:

Table 4.5: Pseudonyms used in the research

Schools' Name using pseudonyms	Participants' names using pseudonyms
Violet Government School	Pranish
	Raj
	Mohamed
	Nishi
	Karen
	Wendy
Sandy Government School	Riyaad
	Krish
	Kanen
	Ludy
	Poovani
	Trisha

Sandy Government. School represented for the average school, and Violet Government School represented the Star School. One criterion for the selection of schools was that the schools were all government schools with various levels of students. The reason behind this was easy gate keeping entry to government

schools. More explanation on the justification for choosing these two schools has been given in Section 4.3.1.

Moreover, the gender of the participants was another criterion for the selection of the participants. Out of the six, three were boys and three girls. The reason behind choosing participants of different gender was to ensure balance and fairness. According to Nelson (2016), people of different genders have their own 'set of rules, beliefs, behavioural expectations, and verbal and non-verbal symbols' (p. 1). Thus, specific characteristics of participants from both genders could have eventually influenced their learning through digitised resources and this was another reason for choosing participants from both genders.

Moreover, in Mauritius, learners with disability go to specialized schools and the sample did not include those specialized schools. If specialised schools were considered, it would bring in an added dimension into the study which was not the focus of the study.

4.7 Section 5: Ensuring trustworthiness and authenticity

In conventional quantitative research, integrity of the research is explained through principles of validity and reliability being ensured. 'In quantitative research, researchers are concerned about specific inferences made from test scores' (Creswell, 2000, p. 125). However, 'in qualitative research, investigators make use of the views of participants to analyse data' (Creswell, 2000, p. 125). Researchers usually decide on the most appropriate period to remain in the field until saturation. Patton (1980) iterated that 'the investigator in qualitative research normally goes back to the data several times to make sense of the constructs, categories, explanations and interpretations' (Creswell, 2000 p. 125). Furthermore, Altheide and Johnson 1994 termed the sense-making process as 'validity-as-reflexive-accounting' (Creswell, 2000 p. 125). The validity procedures present labels such as trustworthiness and authenticity (Creswell, 2000 p. 126).

4.7.1 Trustworthiness

Lincoln and Guba (1985) and Travis (1999, p. 1043) argued that 'there are appropriate approaches to ensure trustworthiness in qualitative study and they

defined these criteria as credibility, dependability, transferability and confirmability'. 'Credibility is used instead of internal validity, dependability instead of reliability, transferability rather than generalisability or external validity'. Guba and Lincoln (1989) and Travis (1999, p. 1043) proposed that credibility is the degree of correspondence between the realities of the participants and the closeness that the researcher interprets their intentions and realities. They posited that confirmability is equivalent to objectivity. However, Travis (1999) viewed both dependability and confirmability to be parallel to reliability as he argued that multiple realities exist in research using the interpretivist paradigm. Rapport (1970) and Travis (1999, p. 1043) also agreed that 'the interpretivist acknowledges bias and subjectivity in data collection and works within a mutually acceptable ethical framework' (Travis, 1999, p. 1043). Guba and Lincoln (1989), explained 'dependability is where the stability of the data can be traced or tracked'. Guba and Lincoln continued by arguing 'confirmability is the extent to which interpretations are rooted in the natural contexts and persons' and not simply fictitious. Guba and Lincoln (1989) found that data could be traced from their sources and in the logical and coherent structuring of the interpretations into explicit and implicit in the narrative of a case. Moreover, a qualitative study should contain rich details to show transferability of the outcomes where the receivers can make judgements.

Since, this study is a qualitative study, the constructs of trustworthiness were ensured through collection of data from multiple sources. The data from one source would inform data from other sources. For instance, learners were asked to transfer their understanding of the concepts through drawings and they were then interviewed on their drawings. Besides, observation was used to capture the learners' interaction when they were learning through the digitised resources. All these sources of data helped in enhancing the trustworthiness of the research.

4.7.2 Authenticity

Another major 'methodological issue that researchers face in qualitative research is the reliability and representativeness of the sample' (Seale & Silverman, 1997, p. 379-380). The term authenticity is used instead of reliability in qualitative research. Authenticity is reached when the data about people's experiences is

'authentic' and usually open-ended questions are mostly used (Seale & Silverman, 1997, p. 379-380). Since qualitative study are done with small sample size, the interviewer's and the respondents' rapport can be established better to ensure authenticity of the data. **Table 4.6** illustrates the ethical considerations that were considered using the Guba and Lincoln (1989) constructs of trustworthiness and authenticity.

Table 4.6 : Ensuring trustworthiness and authenticity in the research

Criterion	**Description**	**How the criterion was ensured in the study**
Credibility	'The confidence that can be placed in the truth of the research findings' (Anney, 2014 p. 276).	Brickhouse (1992) advanced that in case studies research, the investigator depends on the subjects for data and trust and cooperation is crucial. Correspondingly, the researcher planned for an introductory session of two weeks with all the students in the classes and the teacher to familiarise the students with the equipment and the researcher. This prolonged period of time before data collection allowed the researcher to build trust and rapport, thus enhancing the credibility of the research. As a former primary school teacher, the researcher had experience of working with primary school learners and being a lecturer in the field of education, the researcher's position was reviewed to that of the researcher while embarking the field. Data was collected using multiple sources: observation, interviews,

Criterion	Description	How the criterion was ensured in the study
		drawings, videos, researcher's reflective journals. The videos were transcribed at very short time intervals. Creswell (2003) posited that the researcher should ensure that 'respect the rights, needs, values and desires of the participants' are considered (p. 202). Thus, all students (whether directly or indirectly involved in the research) were asked to carry out the drawing activity to maintain trust in the participants.
Dependability	Refers to the stability of findings over time (Anney, 2014). Includes participants checking the findings to ensure that the findings corroborate with the data received from the participants (Anney 2014).	The researcher engaged into a reflexive mode by taking notes in researcher reflective journal for each participant organised by time and date. Peers were asked to review transcripts of the interviews and the videos and then the researcher discussed with them to align the transcriptions with the data from the video and the audio recordings.
Transferability	Refers to the degree to which the data can be transferred to other contexts (Anney 2014).	Empirical evidences of learning through digitised learning resources were gathered in natural classroom situation in Mauritian primary schools. Moreover, dummy cameras were placed in the classes two weeks before starting data collection to ensure that the data remains authentic and trustworthy as well. Hence,

Criterion	Description	How the criterion was ensured in the study
		the data could be transferred to a context similar to Mauritian primary school context.
Confirmability	Refers to the extent to which the outcomes of an inquiry can be confirmed by other researchers (Anney, 2014). It ensures that the interpretations are not the investigator's mere imagination but are results from the data (Tobin & Begley, 2004, as cited in Anney, 2014).	The data from the semi-structured interviews were confirmed through group interview. Moreover, since the participants were children of eight to nine years old, the researcher could not engage in member checking the transcripts but used multiple sources of data to ensure that the interpretations were not fictitious but were derived from data from the field and also to confirm the outcomes. The two professional who videotaped the lessons were not involved in the interpretation of the data. Moreover, videotaping of the lessons allowed me to confirm the data with the transcripts. The chronological order of the collection of data was intentional to probe deeper into confirming the data collected by the different methods. Hence, the analysis and discussions were derived from the multiple sources of data.
Authenticity	Authenticity in qualitative research is reached when criteria like fairness, enlarging personal constructions,	The authenticity was ensured as the participants were observed in their natural classroom situations. Authenticity was also reached through the participants' drawings. The researcher

Criterion	Description	How the criterion was ensured in the study
	stimulating others and empowering others are ensured. (Travis, 1999).	ensured fairness as all the students in the class participated in the drawing activity. Moreover, each drawing was the participant's unique and authentic representation of his learning. The questions asked was based on the drawings which enhanced the authenticity of the research.

Adapted from Guba and Lincoln (1989) and Anney (2014)

4.8 Conclusion

This chapter has described the research design and methodology adopted. It justified the choice of the interpretivist paradigm and the qualitative research approach. Furthermore, the researcher's ontological and methodological stances were declared. The methodological approach of the study was the case study methodology where the participants were Grade 4 learners. This chapter also describes gaining entry into the field processes and working with primary school learners. Following this, it presented the sampling procedures with appropriate justifications. It also detailed out the route for data production where a description and justification of the research methods and tools was given. Consequently, various methods and tools were used to actually enhance the confirmability of the research findings. In doing so, the researcher was able to observe the participants' learning through the digitised learning resources in their natural classroom contexts and in different ways. This chapter also described the procedures for presentation and analysis of the findings; the elaboration of the construction of stories from the data collected and the analysis of these stories to arrive at a higher level of abstraction. Furthermore, a detailed account of how ethical issues were considered and addressed in the study was provided. The last section of this chapter described how the researcher ensured authenticity

and trustworthiness during the study. The next chapter steps into the data analysis phase where the researcher starts to build more insights about the phenomenon to finally contribute to the body of knowledge.

Part 4: Analysing learners' learning through digitised learning resources

Chapter 5: - Presentation of findings

5.1 Introduction

The previous chapter discussed the research design and research methodology that were adopted to conduct this study. Moreover, the ethical considerations and measures taken to ensure trustworthiness and authenticity were presented. This chapter provides a rich picture of the research site by presenting the information through short stories on each participant's learning. Data obtained from the different sources were brought together and synthesised into creative short stories to show learning through digitised learning resources. These stories allowed the researcher to gain a deeper insight into the phenomenon under the lens. Moreover, this chapter helps to uncover learning within the metamodern era where circumstances and contexts may differ.

5.2 Presentation of findings in form of short stories

5.2.1 The complementary swing

Krish's story is written in the form of a conversation with his Mum. Here, the first person narrator is used. Krish describes his learning experiences through the digitised learning resources. The reason for choosing to narrate the story using the first person is to capture the emotions of Krish in the story. The title reflects Krish's learning.

Title: The complementary swing

Krish returned from school smiling happily.

'Hi, Krish!' his mother, Mrs Masha, greeted him. 'How was school today?

'Hi, Mum.' Krish replied excitedly. 'School was really fun! I learnt so many things in my science class!'

That's nice! I'd love to hear about it. You don't always tell me what you do at school but I'm really curious to know what makes you wear such a beautiful smile on your face,' Mrs Masha said, pleased to see how cheerful her son was.

'There are days when I don't feel like talking about school,' Krish admitted, 'but today's lesson was very interesting — it was completely different from our usual classes!'

'What was so different?' Mrs Masha asked, intrigued.

'Well, Mr Steve was already in the classroom waiting for us after recess. He asked us to hurry up or we would be late for our science class. As we rushed into the classroom, my friend Danny suddenly shouted, 'Youpie!' I looked up and saw an interactive projector. Mum, do you know what an interactive projector is?' Krish asked his mother.

'No, dear. We used a blackboard and chalk when I was at school. What's an interactive projector?' Mrs Masha wondered.

'It's a projector that allows you to write using a marker on the board,' the little boy explained.

'What's so special about using a marker to write on the board? This is what is done in all schools now!' Mrs Masha pointed out sceptically.

'Oh, Mum!' Krish let out impatiently. 'This is *another* type of marker. The projector projects images on the board, just as our neighbour Mr. Dev uses his projector

to watch films. But this one is special because we can use the marker to move items or write on the whiteboard, just as we do on the laptop.'

'Wow!' exclaimed Mrs Masha truly impressed. 'I've never seen this. The lesson must have been even more interesting. Do tell me more about it.'

Krish took a deep breath and said, 'Well, Mum, the teacher started the lesson by telling us that we were going to learn about the state of matter that is 'air'. He showed us images of the experiment on air on the board to introduce the topic and then asked us few questions on 'air'. Mr. Steve then showed us a short video clip. It showed a funnel immersed in a bucket of water. The funnel was titled and bubbles of water started to move to the top of the bucket to indicate that air is present in water. We could even hear the sound of the bubbles coming out of the funnel. It went like that: blu, blu, blu…

The eyes of all pupils were glued to the screen as the images moved. The video showed how the presence of air in the funnel through the bubbles. During the animation in the video, a label was shown where it was written: 'Bubbles of air coming out showing presence of air'. After the clip, we could understand and remember everything as though we had done the experiment ourselves. I tell you Mum, it was so real! My friends' mouths remained open in awe. Nella and Arifa, were smiling and said that they enjoyed lessons when the teacher uses the interactive projector. In fact, my friends and I were more interested in the images rather than the teacher's explanation. The class was quite noisy as all the pupils were busy talking to each other and Mr. Steve had to call for our attention a number of times.'

On noticing Mrs. Masha's stern look, Krish quickly said, 'Please Mum, do not scold me for being talkative. Every time Mr. Steve uses the interactive board, my friends and I chat about what we are learning. Mila related what she saw in the clip to her experiences of playing in the bathroom. Therefore, I asked her if the bubbles really came out. Jason told us that he had seen this in a cartoon. Ludy even shouted 'Wow!' during the projection because the experiment being shown was so much like the games she played on her laptop. It had the same colourful

and lively images. When the bubbles started coming out from the funnel that was immersed in water, Mila shouted, ‘Hurrah! This is so nice!’

‘This sounds very exciting!’ said Mrs. Masha. ‘In my time, we used the textbook and blackboard. Did you have to do any work in your exercise book after watching the experiment?’

‘No, not in our exercise book. After the demonstration, Mr. Steve asked Mohamed to move the images in the correct position on the whiteboard,’ Krish explained. And he went on in the same enthusiastic tone, ‘You know, Mum, it’s just like the puzzle game I play on Dad’s laptop.’ He paused to show his mother the game on his dad’s laptop and demonstrated how to drag and drop.

‘I really wanted to use the marker to drag and drop and pleaded for Mr. Steve to send me to the board.’ I was disappointed when he told me that we had to wait for our turn. I was so impatient that I kept moving about on my chair. Learning with the projector is great but what I liked the most is that each time we tried to do something on the board, Mr Steve said ‘very good!’ This was very encouraging and motivating. Mum, are you still there?’ Krish asked suddenly.

‘Yes, of course, my son. I’m fascinated by what you are telling me and would like to use this board too!’ replied Mrs Masha.

‘Mum, when I looked around the classroom, I saw all the pupils trying their best to answer the teacher’s questions; even Rita, the girl who never talks in class,’ said Krish.

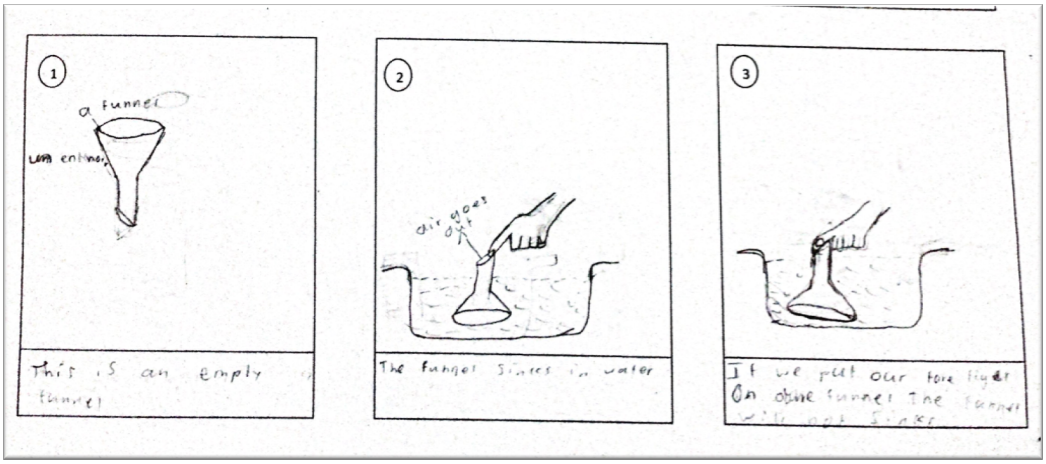
‘You know, Mum, I’m still thinking about the way I was constantly walking to and fro in the science class yesterday!’ he laughed.

‘Well, I am just imagining what you just told me and it should indeed be very interesting,’ replied Mrs Masha.

‘Sure Mum,’ replied Krish

‘I’m hungry now Mum, can we go to eat,’ said Krish.

‘But Mum, before breaking to eat, let me tell you briefly about my drawings, ‘said Krish



I reproduced the images that showed the different stages of the experiment on the interactive board. Below each drawing, I wrote what was happening. I have drawn a funnel just like in the video in the first picture. I then drew the funnel in a basin of water with my finger at the top. In the second grid, I wrote, ‘air goes out’ to show the presence of air in water and in the last grid, I drew my finger covering the top of the funnel for air to remain in the funnel. The teacher saw it and said that I had understood the concepts.

‘Unfortunately, I could not draw all that I had seen in the video, such as bubbles coming out from the funnel, and I did not have time to colour the drawings,’ said Krish in a sad voice. ‘However, I could write about what happened in the experiment.’

‘It does not matter, Krish. Your drawings are very clear. I am so happy to see that you have understood the topic. Well done, my son!’ replied Masha. ‘I’m sure you prefer learning through this new mode.’

‘Not totally, Mum’ replied Krish.

‘Really? Why not?’ asked a surprised Mrs. Masha.

‘Because Mum I’m used to learn when the teacher used the traditional whiteboard and marker. Even though the images projected are very colourful, interactive and enjoyable, I also like to learn through the traditional whiteboard,’ Krish explained.

‘But you just said that you were very happy when you saw the clip with the images and so on,’ said Mrs. Masha still puzzled.

‘That’s because the interactive projector is not used during all the classes. When the interactive projector is used, it is exciting but I can still learn through the traditional board and the marker because all my teachers have been using them since pre-primary school. In fact, when the teacher draws on the whiteboard using the marker, I can remember better. If the interactive projector is taken away from the classroom, it will not really affect my learning,’ said Krish.

5.2.2 ‘Yes I can’

The story of Ludy is written in the first person as Ludy narrates her experiences of learning through the digitised learning resources. In this narrative, I chose to juxtapose two lessons to highlight how Ludy learns in different ways. The title ‘yes I can’ was decided to show the rise in confidence that Ludy showed when she was asked to go to the IWB.

Title: ‘Yes I can’

Hi, I’m Ludy. My school, Sandy Government School is situated in the midst of Universities, a temple, a mosque and a stadium. It looks like any other government primary school in the country but it is MY school. My friends and I are in Grade 4 and we love coming to school because we are often given the chance to experience new and interesting ways of learning. These new experiences make us enjoy learning.

Do you know what the IWB is? It's a wonderful tool that allows colourful images to be projected on the whiteboard when you use an interactive projector. The whiteboard becomes interactive and you can see images moving. We can also use a special pen to carry out activities such as drag and drop, writing words or matching items on the interactive board. Generally, when my teacher, Mr. David, gives explanations using images and written texts on the IWB, our eyes are glued to the screen to make sense of the explanation.

At times, Mr. David moves the images on the IWB during the explanation. For example, when he was explaining the topic 'water cycle', he dragged and dropped labels to indicate the different processes. I could derive meaning from the explanation because I could see the images of the different processes involved in water cycle moving one after the other in the right order. At times, we are also asked to do activities such as drag and drop or fill in the blanks on the board using the special pen. These activities are more enjoyable than those we do in our exercise book and the traditional board.

The colourful images allow me to associate the concepts with my daily experiences. For example, when the teacher explained the topic 'animals', I could link the images on the IWB to animals that I see often or animals that I know. My best friend Asha also says that she learns and remembers better through the IWB.

Mr. David started using the IWB this year, when we came to Grade 4. Once, when we were in Grade 3, we had had the opportunity to observe another teacher using it and we had been so envious of her pupils. I found the way the information was presented through animated images in a sequential manner amazing and thought, 'When will we use this in our class?' Finally, that day arrived! I will never forget the first day our teacher used it.

One afternoon, Mr. David had decided to conduct the class using the digitised learning resources to teach the topic 'Air. My friends and I started to chat happily while Mr David was busy installing the equipment. Having spent more than three years with my friends, it was easy for me to detect the changes in their mood. They were all busy moving around and being talkative and an air of excitement

had replaced the usual quiet (sometimes even monotonous) atmosphere of the class. I noted the happy expressions on all my classmates' faces. It seemed everyone was eager for the lesson to get started. These were not the tired or gloomy faces that few of my friends usually had during afternoon classes, especially after recess. Most noticeable was the anticipation of students who always remained silent in the class. It was such an unusual scene that it is vividly imprinted in my mind.

As Mr. David switched on the interactive projector, we were greeted not by the teacher's drawings on the traditional whiteboard, but by colourful images supported by words and sentences. We all started to look at the images and read the words without even listening to what the teacher was saying. It was quite different from our traditional classroom and so interesting! *It felt like a movie had just started!*

As the lesson on 'Air' started, I was perplexed to see a bottle next to a basin of water projected on the IWB. During the first few minutes, I asked myself 'Why is this bottle next to the basin?' I was so curious that I could not remain seated. I stood up and moved around the classroom, asking my friends why the bottle was placed next to the basin.

Then, Mr David pressed on the play button on the screen, the bottle started to move upwards. The bottle was then tilted and immersed in the basin of water. I was still very curious about what would happen. Bubbles of air started coming out of the bottle. Then, Mr David paused the video and explained that the bottle was not empty and it was filled with 'Air'. As he spoke, he used his ruler to point to the images.

I turned to my friend, Rani, and told her, 'It's the same when I dip my small bottle into the bathtub! Bubbles came out from the bottle but at that time, I did not know that it was because of the air that was present in the bottle.' Now, after Mr. David's explanation, the animation and the discussion with my friend, I understood that clearly.

However, when Mr. David suddenly asked me to link what I could see with my everyday life experiences, I was scared and a bit embarrassed to answer in front of the whole class. He must have realised that since he came to me and gently said, 'Please go to the board and show me what happens when the bottle is immersed in the basin of water.' He smiled encouragingly as he handed me the special pen. This made me more confident and I took the pen. I walked to the board silently and slowly, wondering if I would be able to do it. I tried to carry out the activity but faced many difficulties. It was not easy to move the bottle. I started feeling nervous and troubled as I felt silly in front of all my friends but Mr. David helped me by taking the pen and showing me how to do it. 'It's simple,' he said. 'You just have to drag the empty bottle into the basin of water while tilting it a little. Then, write a short sentence to say what happens below the basin of water using the special pen.'

'Ouf!' I let out a great sigh of relief. Thanks to Mr. David's support, I became a little more confident and successfully carried out the activity. I saw bubbles coming out of the bottle as soon as I immersed it in the basin of water. It was amazing!

I returned to my place, unable to believe that I was in the same traditional classroom where we usually sit in rows and the teacher stands in front of the class explaining concepts on the whiteboard; the same classroom where we rarely go to the board to carry out activities. I can say that the IWB has changed my experience of learning largely. Our teacher was not just explaining to us but creating opportunities for us to participate actively in the lesson. Our involvement made learning take place much more easily.

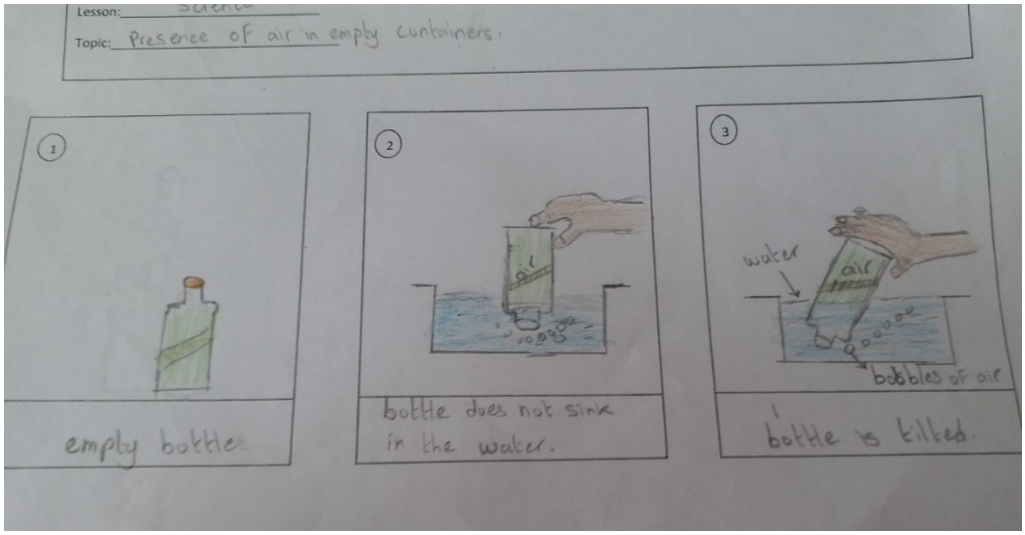
'Mr David will surely use the IWB more often,' I mused to myself.

Surely, no one would think of removing the IWB from the classroom after seeing how it made learning interesting and active. In addition, on the traditional whiteboard, the teacher has to draw and erase after each explanation. Not only is it more time consuming but also the drawings made by the teacher are not as attractive as those shown on the IWB.

Thinking how wonderful it would be to learn all the lessons from the different subjects on the IWB, I was somewhat taken aback when another teacher came to the class and announced that the IWB would be removed from the class as from next week. The lines on my friends' faces and mine were carved with discontentment and the whole class immediately shouted 'Noooo!' in shock and horror. Luckily, the other teacher just smiled and said that he was just joking.

At the end of the lesson, Mr. David gave us paper with three grids and asked us to draw what we had understood.

I enjoyed that exercise of drawing as it helped me to present what I had learnt in an interesting and creative way!



In the first grid, I drew a bottle. I wrote 'empty bottle' below but in fact the bottle was not empty. I did so to later prove that the bottle was not empty. In the second grid, I drew some bubbles of air starting to come out to show that the bottle was filled with air. The second drawing was based on the activity I had carried out on the IWB. As I had dragged the bottle into the basin of water, the bottle had not sunk because it was filled with air. That interactive activity had really been helpful! In the third grid, I drew the bottle slightly tilted and drew more bubbles coming out from the bottle. This indicated that the positioning of the bottle allowed more air to come out from the bottle when immersed in water. As a title for my drawing,

I chose to write ‘Presence of air in empty containers’. I did not write empty bottle because I believe that this experiment can be carried out using other containers as well.

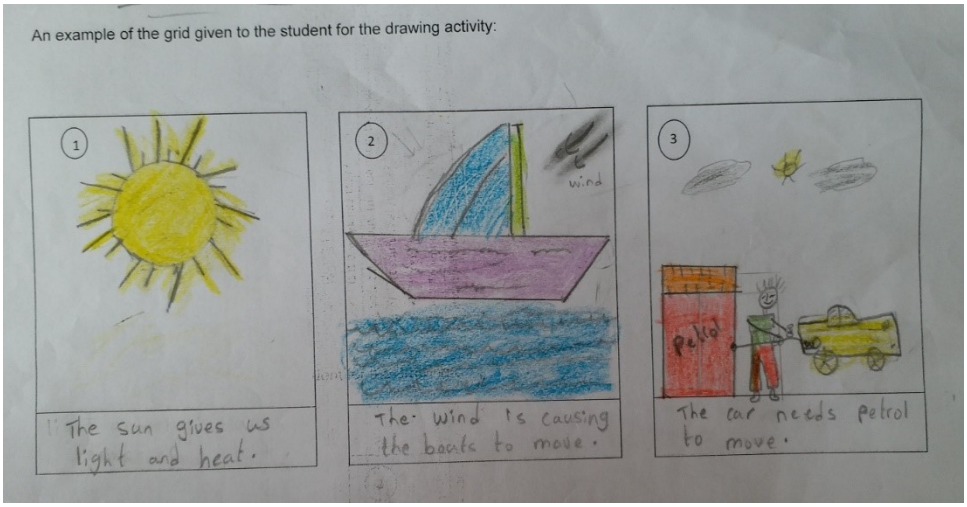
Before learning through the IWB, I did not have much interest in science. This resource has changed the way I learn. I have become more confident about manipulating objects and have started to think critically about the concepts because the visuals and animations in the digital resource helped me to better understand the concepts.

I derived so much enjoyment while learning through the digitised resource that first day that, as soon as I returned home, I told my parents about my experiences in the science classroom and how I enjoyed learning through the IWB. I told them how I had been filled with curiosity.

My Mum raised her eyebrows with surprise as she listened to me. She told me that she had never heard about the IWB before and that it sounded very interesting. She even added the teacher should use it more frequently as the use of the IWB allowed me to learn more effectively. She was right indeed. Now, when we did not understand concepts taught through the traditional whiteboard, Mr. David shifts to the IWB.

It all got even more interesting when he taught the lesson on ‘energy’ using the IWB. Many animated images were used sequentially to explain the importance of energy. We were shown a woman hanging clothes to dry and the bright sun indicated how heat energy helps to dry clothes. There were also other animations to illustrate and explain concepts related to wind energy and movement energy. Each time the explanation was followed by simple activities to consolidate learning and verify our understanding of the concepts.

What a noisy class it was that day! All of us were eager to share our experiences as we could relate so easily to the visuals. Nobody could sit quietly as during normal lessons. At the end of the lesson, we were asked to represent our learning of the concepts through drawings.



Drawing in the grids was not something simple, as I had to summarise what I had learnt from the digital resources into the three grids. In the first grid, I drew the sun because if the sun had not been present, it would have been very cold. That is why I wrote, 'The sun gives us light and heat' below the drawing. Moreover, during the day, the sun gives us light so that we can see and do activities using light energy.

The second grid showed a boat moving. I drew two arrows to indicate the winds moving the boat in a specific direction. Then I wrote, 'The wind is causing the boat to move' below the drawing.

The drawing in the third grid reflected a common sight as every day I pass by a petrol station and I can see vehicles being filled up with petrol. Thanks to the IWB resource, I had understood that the car needs petrol as the chemical energy allows the car to start and move. Petrol is therefore a source of movement energy. In the last drawing, I included all three sources of energy: the sun, the wind and petrol to show that energy does not come from only one source.

The topic that Mr David was explaining was new and the visuals and animations shown on the IWB allowed me to discover new things or verify things that I did not pay attention before. The video was so lively and clear that it helped me to remember the concepts better, especially when they were coupled with Mr David's explanations. I must say that learning concepts through the IWB has allowed me to think critically and make links with my experiences. In addition, the

well-labelled visuals prevented me from confusing the forms and sources of energy. I also gained self-confidence since I was able to manipulate the special pen to carry out the activity on the board. Moreover, my self-esteem was boosted as I successfully carried out the activity in front of my friends. I had never thought that I would be learning so much before we had started to use the digitised learning resource.

5.2.3 Effective but limited

The story of Poovani is presented using the third-person narration during the learning process. My decision was motivated by the fact that Poovani was an introvert and introvert persons do not generally open up to other persons.

Title: Effective but limited

Poovani was an eight-year-old girl. She lived in Green City and attended Sandy Government School, a primary school situated in the same area. She was in Grade 4. She was regular at school and always followed the class attentively. She was well behaved and liked by both her teacher and friends.

Poovani's class had remained unchanged over time; it was the typical traditional classroom set-up where students sat in pairs facing the whiteboard. In fact, it might have been the same set-up as her parents' classroom with the same old furniture, chairs, and tables arranged in rows had it had not been for one element: the recent inclusion of a projector in front of the classroom, next to the whiteboard. When switched on, the projector displayed images on the traditional whiteboard and turned the latter into an interactive one. This never failed to fascinate Poovani. The vivid and colourful images aroused and sustained her interest throughout the lesson as could be seen by her eyes that rarely left the display.

Poovani's teacher, Mr. Samy, was middle-aged with many years of teaching experience in Grades 4, 5 and 6. He was very passionate about his profession

and always strived to use innovative teaching approaches to meet the needs of his young students. Though the class had 32 students which is generally deemed a substantial number in the local context, Mr. Samy had a good rapport with all his learners and encouraged them to participate in the class discussions through different techniques. He was indeed a dedicated teacher, as all his pupils would testify.

That day was a very hot afternoon and all the students were tired. They were all happy after spending time with their peers during recess and their lack of enthusiasm to get back to the classroom was betrayed by their whispers as they lined up and walked reluctantly towards the main building.

In the classroom, Mr. Samy was completely absorbed setting up the laptop and the projector with the help of the ICT teacher, and getting ready to teach a science lesson. He called for silence and announced: 'We're going to have our science lesson on 'Energy', and we will use the interactive whiteboard.' Instantly the morose faces lit up and all the students smiled exultantly. The class became noisier and students were impatient to get started. Sounds of chairs moving and children shouting could be heard. Few students were on the alert trying to help Mr. Samy install the equipment even though they knew nothing about it. Just a sudden announcement that the usual traditional classroom would be converted into a digital one had caused the atmosphere to change into a lively one! All the students were beaming. A smile could be seen on all students' faces.

A brainstorming session was carried out by Mr. Samy to elicit prior knowledge from pupils about the topic and the students participated actively in the discussion.

'Sir, I have lots of energy; that's why I can run quickly!' said Alan, standing near his chair.

'Sir, the aeroplane needs energy to move!' shouted Pinky, walking in front of the class to gain attention.

'Sir, Sir… hmm energy is essential for anyone to do activities!' said Ronnie in a loud voice, raising his hands impatiently.

‘Well said, children!’ said Mr. Samy.

He then displayed a series of images, both static and animated to support his explanations. On showing an image of the sun shining brightly in the sky. Mr. Samy asked the students, ‘What can you see in this image?’ In a loud voice, they replied, ‘The Sun.’

Then, Mr. Samy put another question to the class: ‘How is the sun useful to us?’

All the students became silent, pondering over the question. After a few minutes, Mr. Samy projected the images on ‘forms of energy’ on the IWB. The images showed the sun uses ‘heat energy’ to dry clothes and they were supported by written text. Mr. Samy then asked the students to provide more examples. The class grew very noisy, as many students were eager to answer. Mr. Samy therefore asked them to raise their hands if they wanted to answer. Some students were so eager to answer that they shouted out, ‘Me … Me!’ Almost all students were actively participating in the lesson with the exception of Poovani.

Unlike her friends, Poovani was very timid and did not volunteer to answer or go to the board to carry out an activity using the special pen. Her lack of confidence was puzzling: *Why was she silent? Was she still reflecting on the concepts or was she hesitating to go to the board due to shyness? Did her silence influence the way she learnt or interacted in the class?*

Poovani always followed the lesson attentively to understand better and obtain good results. Indeed, from time to time, she opened her copybook and wrote in few words related to the explanation.

As Mr. Samy carried on with his explanations, he asked, Poovani’s friend, Ronnie, to write what he could see in the animated images in the space provided on the digital resource. Ronnie managed to carry out the activity correctly and the teacher praised him.

Suddenly, Mr. Samy asked Poovani, ‘What is the form of energy from the sun?’ Poovani answered a very concise manner by saying that the heat energy is the form of energy from the sun.

‘Well done,’ said Mr. Samy.

The example that follows indicates that Poovani rarely asked Mr. Samy questions to verify her understanding. For example, when Mr. Samy asked all the students whether they have understood the concepts, unlike her friends who voiced out, Poovani just stared at Mr. Samy and then at the visuals on the interactive whiteboard and did not answer.

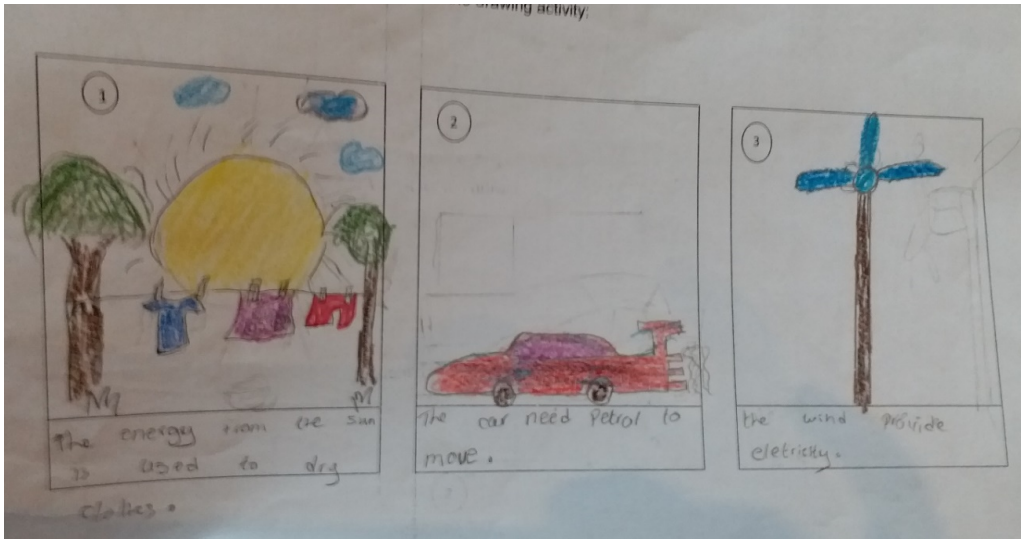
After the class, Poovani told her friend, Katty,

‘I like it when Mr. Samy uses the IWB as the images and animations help me to understand better, but I am not used to participate in class.’

‘I wished Mr. Samy uses the IWB more often as he clearly matches what he is saying with the images and animations’

‘I can recall most of the concepts presented through visuals from the interactive whiteboard for a longer period of time.’

As a summative task, Mr. Samy asked the students to produce drawings of what they learnt from the lesson in order to evaluate their understanding. All the students including Poovani were eager to do so.



In the first grid, Poovani drew a very big sun just behind clothes drying on a line. Mr. Samy was pleased to see that Poovani had understood the concept that heat

energy from the sun is used to dry clothes. He noted that, interestingly, Poovani was creative and logical in her thinking, as she had drawn the cloth line tied to two trees. Upon his query, Poovani explained that her mother hangs clothes on a cloth line tied to trees.

In the second grid, Poovani drew a car moving. She inserted wavy lines at the rear end of the vehicle to indicate movement and wrote, *'The car needs petrol to move.*' There was no doubt that she had understood the lesson and was able to explain that the car could not move without petrol, which provided energy.

In the third grid, Poovani showed how the wind energy provides electricity. Poovani depicted the use of wind energy for the production of electricity. She drew a wind vane and wrote, 'The wind provides electricity.' However, the wind vane is an instrument used to measure the direction of the wind and Poovani could not clearly represent how the wind vane was used to provide electricity in her drawing. Her representation of her learning was effective despite being limited. When the teacher asked Poovani to elaborate on her drawings, she read what she wrote below the drawing.

All her three drawings were closely related to what she had seen in the digitised learning resource and what had been taught. In the first drawing, she was able to make the link with her experiences. In the second drawing, she reproduced only what she had seen from the resources. However, in the last drawing, she failed to provide sufficient details to show thorough understanding.

Even though Poovani was not very talkative in class, at home she liked to share what she has done at school. That day, she was so fascinated by the use of the interactive whiteboard that she told her parents about her experiences as soon as she reached home. She explained to how the classroom had changed with the interactive projector. Even though her parents did not know much about the interactive whiteboard, they were amazed by how their child was able to recall the concepts from the science lesson and explain these with such confidence.

It might be that Poovani was an introvert person as she rarely discussed with her teacher and her friends. However, her learning was effective but limited to what

she saw in the resource. She was able to narrate to her parents her learning but could not totally represent her learning in her drawings.

5.2.4 The 'Eureka' moment

To present Trisha's learning through the digitised learning resource, the researcher chose a conversation with her dad. Insights related to the child's learning are woven within the conversation. The choice of conversation style is because the data revealed that Trisha liked to narrate her experiences. In fact, Trisha showed satisfaction and amazement when she was able to learn the concepts to better through the digitised learning resources and this is depicted in the title.

Title: The 'Eureka' moment

The other day, I sat in the living room chatting about school with my dad. I was telling him about the IWB, the teacher used during the science lesson when he stood up and, giving me a puzzled look, asked, 'What is so special about that class?'

'Haven't you heard about the IWB?' I asked, incredulous.

'No,' he said, shaking his head. 'I have never heard about it but am curious to know all about it.'

I explained to him how the IWB turns the traditional whiteboard into an interactive one with the aid of an interactive projector and went on to tell him how my teacher used it. I then narrated my learning experiences through the IWB to dad.

That day, Mr. Sunil, my class teacher was teaching the topic 'energy'. He started by asking us questions, 'What do you think is energy?', 'Do you we all need energy?' My friends and I tried answer based on what we already knew. Without

replying, Mr. Sunil walked to his table, switched on the laptop and then the interactive projector situated next to the whiteboard. After few minutes, images of the sun, wind and petrol appeared on the whiteboard. We were all amazed to see the colourful images and we tried to link what we were seeing to the questions. Mr. Sunil then started to explain that these are the sources of energy. He then put other questions to let us think more, 'What forms of energy do you think the sun provides? How can we use the energy from the sun in our everyday life?'

Mr. Sunil gave us time to discuss. Many of my friends were busy chatting with others in an attempt to answer the questions. However, unlike my friends, I preferred to follow attentively rather than be in a hurry to answer the questions. I first thought carefully about the questions in order to get the right answer while looking at the images in the digital resource. I raised my hand and answered, 'The sun is hot.' Mr. Sunil said, 'Ahaaa... you are partly right, let us learn more about it.'

After few interactions, Mr. Sunil shifted to the next part of the digital resource. There was a picture of the sun above a clothes line and arrows between the sun and the clothes line. I saw the sun shining through the animations and there were arrows pointing towards the clothes indicating that the clothes were dried through the energy emitted from the sun. It was so easy to understand that heat energy is needed to dry clothes and that the sun is the source of energy.

What I mostly liked was the way the images were presented on the IWB. They were very attractive, lively and colourful. When I was looking at the animated images, I felt like I was watching a movie and trying to make sense of what was happening through the animations. I did not have to concentrate as much as during the teacher's explanations to understand the concepts and the visuals helped me to remember these. In the same digital resource, a second set of animations were about the 'wind energy'. I could hear the sound of the wind in the background during the projection. Mr. Sunil asked us to remain silent, close our eyes and listen attentively to the sound. After few seconds, he asked us to open our eyes and observe the animated images. We saw boats sailing in the

sea using wind energy. I prefer the IWB because is the visuals and animation make learning interesting and attractive. The use of senses eased my understanding of the concepts. Mr. Sunil explained that wind energy is the form of energy while the wind is the source of the energy. Although I was a little confused, as both the form and source of energy were the wind, I preferred not to interrupt the class. However, after the explanation, I discussed with my friends to share my views about what I learnt and clear my doubts. When I looked back at my participation in the class, I remained attentive during the first few minutes. Nevertheless, I always confirm my understanding with my friends after the lesson in order to make sure that I did not miss any important details. By looking at the visuals in the digitised learning resource and listening to Mr. Sunil's explanation, learning the concepts was made easier for me.

The third part of the lesson was on 'movement energy'. The resource showed a car being filled with fuel at the petrol station and it was written 'The car needs petrol energy to move.' I also saw the splash from falling water from an animated image illustrating 'movement energy.'

'Wow … It's amazing to learn through IWB, the images look real,' I told my dad.

There were also hands-on activities in the digital resource. One of the activities was mainly to drag the correct answer and drop in the space given. The teacher asked me to do the activity using a special pen. It was so much fun, just like the games I play on my tablet. Before carrying out the activity, I was wondering whether I would be able to use the pen, as I had never done so before. It was indeed in a stressful situation, as I wanted to ensure that I could drag and drop the image in the appropriate space to show that I had understood the concepts. Fortunately, I did it easily and was happy at my success.

'What was amazing in that class was that I learnt the concept and using the special pen! I have never used such pen in my life before. I remember the things better after having carried out the activity on the IWB. Unfortunately, the teacher rarely uses the IWB, leaving us with little opportunities to use the pen and interact with the resource.'

Besides carrying out the activity, I asked Mr. Sunil several questions to deepen my understanding of the concepts and to clarify my doubts. Moreover, the concepts learnt that day through the IWB were so vivid in my mind that I can confidently explain them to my peers or anybody else.

Dad, I can tell you that I really like learning through the IWB. It is so lively and I can see myself being involved in my own learning. I was not just sitting and listening to Mr. Sunil but participating as well.

Moreover, Mr. Sunil always set questions to make us think more. He generally asks us:

'Why do you think so? ' How would you do this? 'Why would you do this?'

Suddenly, my dad interrupted the conversation and asked me:

'Trisha, do you prefer to learn through the IWB or the traditional board?'

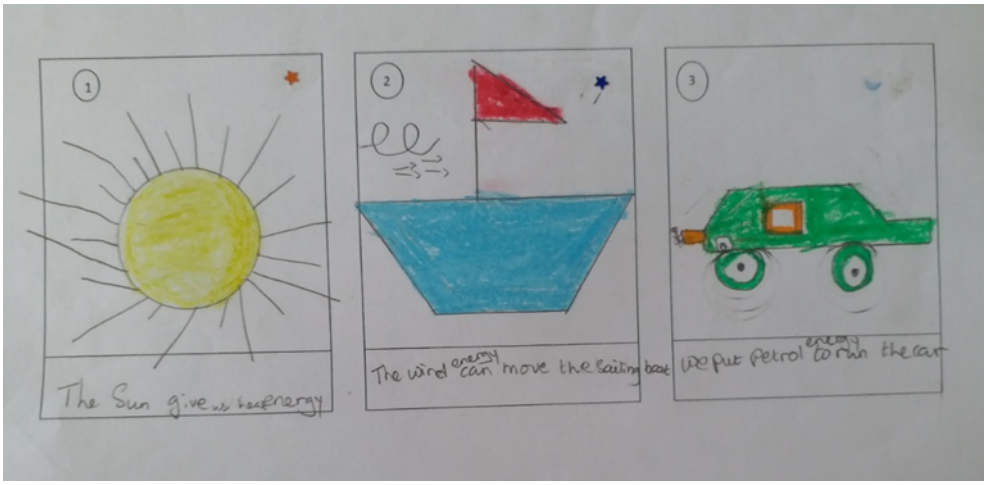
Without any hesitation, I replied:

'You know what Dad; I definitely prefer to learn through the IWB.'

In fact, the features in the digitised learning resource help me to remember the concepts better, especially for the exams. I learn better through visuals as I just have to close my eyes and I can visualise what was on the resource. This allows me to remember even, minute details in the resource. In fact, the visuals in the digitised learning resource are so realistic.

Moreover, the words accompanying the images help me to better understand the concepts. For example, in the first set of images it was written, 'The sun provides heat energy to allow the clothes to dry.' I was able to link the images with the sentences and the explanation of Mr. Sunil.

I drew some pictures to show Dad what I had learnt.



Dad said: ‘I am very happy to see your drawings.’ ‘Can you tell me more about it?’

Confidently and with great enthusiasm, I told dad that the first grid showed the sun. I drew a big sun to indicate that the sun gives heat energy. The sun gives heat and light energy.

Through the digitised learning resource, I learnt about the different forms and sources of energy. In the second grid, the sailing boat needs the energy from the wind to move. In the digitised learning resource, there were animations representing wind energy, but unfortunately, I could not represent exactly what was in the resource in my drawing. I thus drew arrows to represent the wind energy. I also wrote ‘wind energy can move the sailing boat’ to explain that the ‘wind’ is the source of energy that allows the boat to move. In the third grid, I wanted to show that petrol is needed for the car to move. I wrote ‘we put petrol energy to run the car’. I drew a car because there was a car in the digitised learning resource to illustrate the concept of ‘movement energy’.

I must say that my dad was very happy to hear that I enjoyed learning through the IWB. He also told me that he liked the fact that I could discuss my learning of the concepts with him. I would say that I learn better through the visuals and videos in the IWB even though I always confirm my understanding with my peers.

5.2.5 'Just learn it better'

The story for Pranish is told using the third person, where the narrator is outside the story. I used to tell Pranish's story using the third person in order to bring out the child's emotions better. The title was chosen to show how Pranish learnt through the digitised resource.

Title: 'Just learn it better'

A child of eight years old was standing before his class and peering through the window, and smiling. The headmaster of the school, Mr. Paul, approached the child and said, 'My little fellow, why are you looking so happily through the window?'

'I was thinking about what and how I learnt through the interactive whiteboard (IWB) last Monday,' was the child's reply.

Mr. Paul then asked him more about his learning through the IWB. The name of that boy was Pranish and he narrated his learning experiences with the IWB in the science class on topic 'Air.'

That day, Mrs Pim, the class teacher, projected a video on the Interactive White board to explain the concept 'Air.' The classroom setting did not change. As usual, all the students were seated in rows. The traditional board turned into an interactive whiteboard. However, Mrs Pim did not use all the tools or features on the IWB. She just referred mainly to the visuals to support her teaching.

With much enthusiasm, waving his hands while narrating, Pranish explained that when he looked at the images, he could link them to things in his environment. He added that learning through the digitised learning resources allowed him to think beyond what was written in textbooks.

'I enjoyed learning through the IWB as the pictures and animations helped me to understand what the teacher was explaining better,' said Pranish with a large smile.

He explained that the visuals on the IWB helped him to reflect on his life experiences. He also pointed out when he learnt through the IWB, the visuals helped him to memorise fine details of the concepts. He even told Mr Paul:

'Sir, the moment I see the word 'Air' in my textbook, I can visualise the images and animations in the digital resource. It's awesome!'

Pranish explained that, unlike his friends, he was always very attentive in class. He declared that at times, when he was disturbed by his friends during the class, he was quite annoyed and did not reply to them.

'I prefer to rely on the teacher's explanations rather than learn from my friends,' said Pranish

He declared that he was so immersed in learning when the digitised learning resource was used that he did not pay attention to different factors that may affect his learning. Even when Mrs Pim interrupted the class for classroom management, Pranish continued to be in a pensive mode and reflected on what he saw in the digitised learning resource to his life experiences.

'I learnt that if 'Air' is present everywhere, it means that all animals need air to breathe,' said Pranish to Mr Paul

Pranish did not like to discuss with his friends when Mr Paul was using the IWB, as he preferred to pay full attention to Mrs Pim's explanations and to everything, he could see in the resource. Moreover, when Mrs Pim asked Pranish questions on the topic, he was able to respond successfully. Pranish also declared that he questioned Mrs Pim to clarify his doubts or clear confusions. However, Mrs Pim was quite brief in her responses and explanations, leaving Pranish not to fully clear his doubts at all time.

In a loud voice, Pranish told Mr Paul that although he enjoyed that specific science class, he had not been as enthusiastic when Mrs Pim had called him to carry out an activity on the IWB. He said that he was afraid of not being able to carry out the exercise.

‘Mrs Pim asked me to show that air is present everywhere through an experiment with a bottle immersed in a basin of water,’ said Pranish

Pranish narrated that at first, he was quite hesitant, but after few minutes, he could confidently use the special pen and carry out the exercise successfully. Pranish added that carrying out the activity helped him to learn the concepts better. He said that when he moved the objects on the IWB, he linked it to playing of games on his tablet that helped him to increase his self-confidence.

Mr Paul was eager to know more about that class and he told Pranish that when he was at school, there were no interactive whiteboard in classes at that time. Pranish continued by telling Mr. Paul that he was very happy and at ease when the teacher used the IWB to deliver lessons, as it resembles watching videos on his tablet. He added the ‘voice over’ in the digitised learning resource was supporting the different illustrations and aiding him to learn the concepts better and link them to his everyday life experiences.

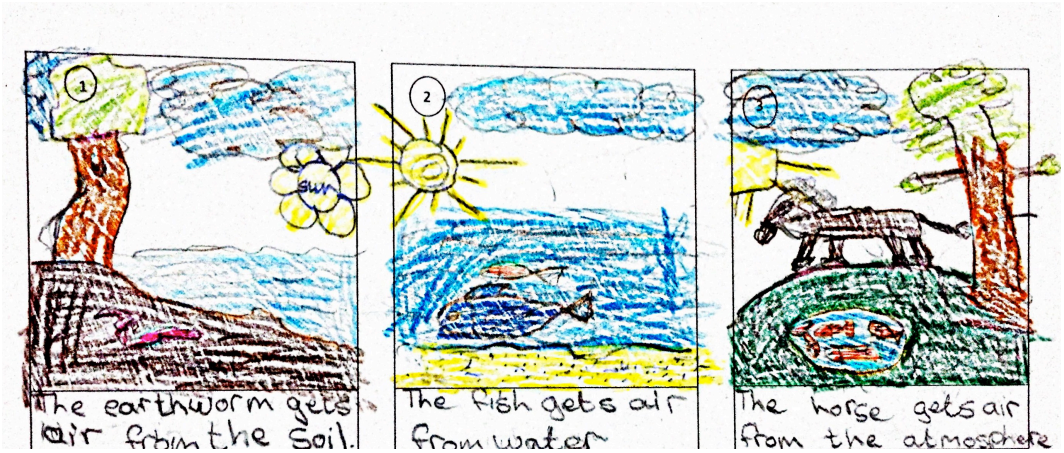
‘I prefer the Sankoré board to the traditional one as I will never forget the lesson learnt through the IWB. The visuals help me to memorise better,’ said Pranish.

Mr Paul frowned and asked Pranish, ‘Why?’

Pranish explained that the digitised learning resources comprised features that allowed him to learn in context. He added the background in the videos allowed him to situate his learning. He was not learning only about the concepts but was also able to relate the concepts to different real-life situations.

Pranish told Mr Paul that at the end of the class on topic ‘Air,’ Mrs Pim asked all students to represent their understanding of the concepts through drawings. Pranish rushed to his bag and removed his drawings to show to Mr Paul.

Pranish said that he represented three instances where animals need ‘Air’ to live: (1) under the soil, (2) in water and (3) above the soil.



He wrote, 'The earthworm gets air from the soil' to explain that air is present even in the soil. He drew how the fish gets air from water showing that air is present in water for the fish to breathe and, in the last grid, he drew the horse standing on the grass and wrote, 'The horse gets air from the atmosphere.' He concluded that even though he drew the horse to indicate that the latter needs air to breathe, he also added the fishes in a pond in the same drawing. He said that he was able to situate his learning experiences in a real-life context.

Suddenly, the sound of the bell was heard and the playground turned noisy. Mr Paul as well Pranish had a large smile on their faces. They greeted each other and ended the conversation.

5.2.6 Enthralled by learning experiences

Raj's learning is told in the third person. The reason for choosing the third person is to have a panoptic view of the whole class including Raj. I was able to include the different elements that influence Raj's learning through the digitised learning resource. The title 'Enthralled by learning experiences' was chosen to depict Raj's learning through the digitised resource.

Title 'Enthralled by learning experiences'

The class was crowded and the seating arrangement was such that all the students were sitting very close to each other. Raj was sitting in the first row with his friend Pamela on his right and Johnny on his left. He was busy talking to his friends when Mrs Lizzy, the class teacher, entered the classroom. Immediately, everyone was silent. Mrs Lizzy announced that she would use the interactive whiteboard (IWB) to conduct the science class and the students appeared fascinated.

'Wow … I really enjoy when the teacher uses the IWB,' shouted Manish

Mrs Lizzy was a very kind and experienced teacher. Since she had been teaching at primary level for many years, she mastered the subjects. Mrs Lizzy had a good rapport with her learners but her teaching methods were mainly teacher-centred. She seldom used the IWB to conduct her classes.

On that day, Mrs Lizzy started explanations on the topic 'Air'. She then switched on the interactive projector and used the images and animations from the digital resource to support her teaching. The teacher showed application of the concepts in real life through the animated images. Pointing to the image of a basin of water, Mrs Lizzy paused the resource and asked the students, 'What can you see in this image?'

All the students, except Raj, had their eyes glued to the screen trying to find an answer to Mrs Lizzy's question. Raj took a quick glance at the screen and turned around to chat with his friends rather than follow the class attentively. Mrs Lizzy did not allow sufficient time for students to answer and she provided explanations on the visuals in the digitised resource.

Mrs Lizzy drew the pupils' attention to the presence of air in the basin of water by scrolling over the image. On the IWB, bubbles of air started to move continuously to the top of the basin of water. A few students were so amazed and impressed that they exclaimed, 'Wow!'

On hearing ‘Wow,’ Mrs Lizzy probed the learners further by asking a set of questions, ‘Where have you seen this before?’ ‘Why do you think bubbles of air are moving upwards?’

Once again, after few seconds, Mrs Lizzy moved on to give the answers herself. She did not create the momentum for the students to think critically and react to the questions. She explained that air is present in water and reinforced explanations with a live demonstration showing the presence of air in water. Her hands-on experiment was done using an empty bottle immersed into a basin of water. Bubbles of air came out from the bottle. Mrs Lizzy then switched back to the IWB where a visual representation of the experiment with the empty bottle of water was shown. Raj looked at the screen for few seconds and then looked out of the window. He then sharpened his pencil. Unlike his friend Pamela, Raj was not bothered about what the teacher was explaining.

Mrs Lizzy then put questions to the students:

‘Do you think air is present in the atmosphere?’

Raj raised his right hand and said, ‘Yes Miss, air is everywhere, it allows us to breathe.’ He took a deep breath to show to Mrs Lizzy that he was breathing the air from the atmosphere. All his friends started to laugh and they imitated Raj.

Mrs Lizzy smiled and congratulated Raj for his reply. She said, ‘Well done, Raj. I’m very happy you could understand that air is present’ (Raj beamed with pride and happiness wearing a large smile).

Mrs Lizzy then played a video where there was a little boy roaming around in a shuttle in the atmosphere. The aim of the little boy was to show that air is present everywhere. The boy in the resource first flew through the trees, then swam in the river and lastly dug a hole in the soil. The animations showed that air is present in the atmosphere for birds on trees to breathe, in water for fish to breathe and in the soil for animals living in the soil to breathe.

This was the only moment when Raj remained silent and concentrated on the video. He raised his eyebrows, looked at the roof and nodded. As soon as the

video was over, Raj told Pamela it had never struck him that air is present even in the soil. He then turned to Johnny and told him that, while he had been watching the video, he felt as if he was the boy in the video, moving around and feeling the air that is present everywhere. Raj added that he remembered vividly what was said in the video, 'It's amazing but I can connect the explanations with my experiences. Watching this video has really made it easier for me to understand the topic.'

However, his attention span was very short. As soon as the video was over, Raj started to chat with Pamela and Johnny. He was absorbed in his narration when suddenly he heard his name. Mrs Lizzy was calling him to the board to carry out a completion exercise. Raj stood up and looked at his teacher. He did not show any reaction and appeared to be deep in thought. Mrs Lizzy gave him a gentle nudge, 'Go ahead, Raj. Don't be shy.'

Boosted by her encouraging words, Raj confidently walked to the board, took the stylus (digital pen), read the sentence on the IWB, and carried out the activity. He filled in the blanks by dragging the correct answers into the appropriate blank spaces. Mrs Lizzy was pleased with his answers and, smiling at him, said, 'Good!' Back on his seat, Raj shared his excitement at having been able to use the stylus to carry out the activity with Pamela, 'I'll tell my parents that I have learnt a new thing today. I have learnt how to use the digital pen to move words on the IWB!' he told Johnny.'

At the end of the lesson, when the teacher conducted a summative evaluation by asking questions, Raj was eager to answer the questions. He referred to what was shown in the video in his responses. Raj also referred to what he heard in the digitised learning resource in his responses. He again told Pamela how happy he was to be able to learn the concept 'Air' as well as manipulate the digital pen.

'As from now on, whenever I will look at animals on trees, on land or under the soil, I will think about this lesson and what I have learnt about 'Air'!' said Raj to Mrs Lizzy.

He also told Mrs Lizzy that the visual representations in the resource had allowed him to situate his learning within his environment. There was no doubt that Raj was enthralled about his learning experiences.

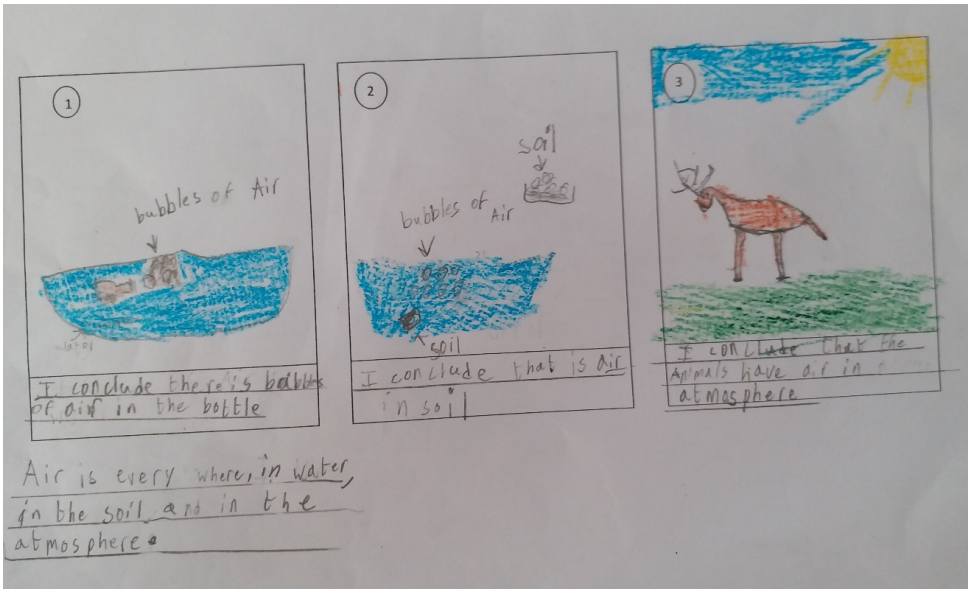
When Mrs Lizzy asked the pupils to represent what they had understood through drawings, Raj reproduced what he learnt from the hands-on demonstration and the animated images with the bubbles coming up from the empty bottle immersed in a basin of water. He even labelled the bubbles of air and indicated these with an arrow. He coloured the basin blue to indicate that the basin was filled with water. Below the drawing, he wrote, 'I conclude there are bubbles of air in the bottle.' Raj replicated exactly what had been shown in the first part of the resource as well as what the teacher had done during the hands-on experiment.

In the second grid, he demonstrated his understanding that air is present in the soil by including the soil in the basin of water. He drew bubbles of air coming out from the soil, which showed his learning of the concept.

In the third grid, he drew an animal standing on the grass and breathing air from the atmosphere, thereby situating his learning in a context. He represented the context or atmosphere by drawing the yellow sun, the blue sky and the green grass on which the animal was standing. Through this, he wanted to bring out that air is present in the atmosphere. However, unlike the drawings in the first and second grids, Raj did not draw bubbles of air to show the presence of air in the atmosphere. Instead, he wrote, 'I conclude that the animals have air in the atmosphere.' In addition, Raj did not replicate exactly what he saw in the digitised learning resource in the third grid. He applied the knowledge he had acquired in a context, which was familiar to him. In fact, when Mrs Lizzy asked Raj to explain what he drew in the last grid, he referred to what he saw during the last educational tour in the animal park, 'Casela' and linked it to what he just learnt on 'Air.' Again, he was able to link his learning with his experiences.

Below all the grids, he wrote one sentence that brought out what he had learnt. He even wrote a general statement at the bottom of the page*:* 'Air is everywhere, in water, in the soil and in the atmosphere.' Even though Raj was not attentive throughout the whole class, he was able to represent his learning in different

contexts. He made reference to all the concepts he learnt from the digitised learning resource and Mrs Lizzy's explanations.



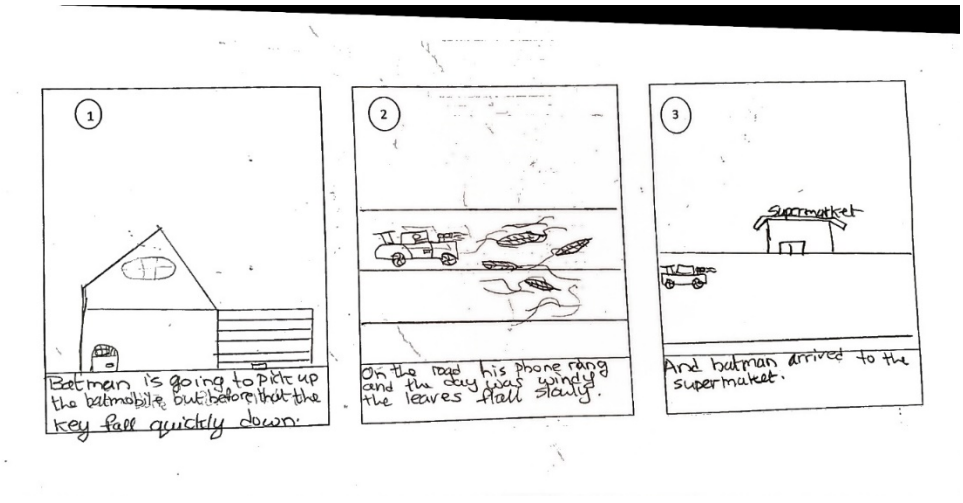
One week after that lesson, Mrs Lizzy conducted another science lesson using the digitised learning resource. This time it was on the topic 'Time'. She provided few examples through animated images on the digitised learning resource. Even though she did not use any video to illustrate the concept this time, Raj told Johnny:

'I understood the concept 'time' well as the objects that fall quickly compared to objects that fall slowly were shown through images in the digital resource. Many examples were shown and this helped me to understand better.'

Raj also told Johnny that during the weekend, he watched a movie in which a few objects were falling quickly while others were falling slowly. In this class also, Raj was not fully attentive to Mrs Lizzy's explanations. Instead of following the teacher's explanations, he was busy narrating what he saw in the movie to Pamela and Johnny. It was evident that Raj had grasped the concept being taught as he was relating his learning of the concept to his personal experiences. His excitement was obvious in the way he was turning to his right and left to explain what he had understood.

Mrs Lizzy then projected an activity sheet with several colourful objects on the right on the IWB. There were also two blank spaces labelled: objects falling quickly and objects falling slowly. The activity required students to choose the right object, drag it and drop it in the correct space. As soon as Raj saw the worksheet, he told Pamela that he would like to carry out the activity as he has learnt how to use the digital pen in the previous class. To his delight, Mrs Lizzy called him to the board and asked him to drag and drop two different objects in the correct spaces. He was more confident than the last time and successfully carried out the activity. Mrs Lizzy as well as his friends clapped to congratulate him. Raj was beaming as the claps resonated in the classroom. Not only had he enjoyed manipulating the stylus but he had also learnt a new concept in an engaging manner.

As in the previous lesson, the teacher asked the students to represent their learning through drawings. This time, Raj produced an amazing set of drawings in a specific context by linking his learning with what he had seen in the movie. He displayed his acquisition of knowledge and understanding through a scenario and in a chronological way. Raj was so excited to show Mrs Lizzy what he had learnt that he quickly completed his drawings without colouring them.



He drew a house with a garage and wrote, ‘Batman is going to pick up the batmobile but before that the key falls quickly down.’ Raj did not replicate what was shown in the digitised learning resource, but applied his learning to other situations. He could link what he learnt in the class to what he saw in a movie

during the weekend. Moreover, he illustrated his drawing with complete sentence.

In the second drawing, Raj gave a continuity to the story by integrating his learning of the concept 'Time.' He wrote, 'On the road, his phone rang and the day was windy, the leaves fall slowly.' With a large smile, an expression of satisfaction and pointing at the second drawing, Mrs Lizzy told Raj:

'Your drawing is wonderful! Can you please tell me more?'

Raj excitedly stood up from his chair, put his hands on his waist, and said, 'Well, this second drawing shows that Batman is driving his batmobile while answering his phone and the weather is very windy outside. The leaves are falling everywhere because of the strong winds. The leaves fall slowly because they are light and they take more time to fall.'

Amazed by the explanation, Mrs Lizzy told Raj:

'Wow, what a nice scene. I am now eager to know what happens next. Can you please explain your drawing in grid 3?'

Raj said, 'Well, Mrs Lizzy, in drawing 3, I wanted to give an ending to the story and I wrote: 'And batman arrived to the supermarket' just below the drawing.'

Mrs Lizzy congratulated Raj and was very happy. She said:

'Well done my boy, I am very happy that you are able to link what I have just taught to your experiences. It's original and unique.'

Mrs Lizzy was very happy to see that Raj could learn the new concept and reflect on its application in a context. She told Raj that he had been very creative and proudly showed Raj's drawings to the class. Raj was very happy and thanked Mrs Lizzy for her appreciation.

5.2.7 Engrossed in learning

Karen's story is told using the third person as Karen did not like to socialise in the class where the teacher used digitised learning resources. The choice of the title also was in light of the observation made on 'karen' interactions during the classes using the digitised learning resources. Karen was a very reserved and attentive child who did not like being disturbed during the class. Hence, the choice of 'engrossed in learning' as title.

Title: 'Engrossed in learning'

It was a Friday afternoon and she was sitting in the first row in a crowded classroom. Her name was Karen and she was a seven-year-old child with a pleasant personality. Karen was a serious and attentive student who did not like to be disturbed her during the class. She rarely interacted with them when the explanation was on. She respected others when they were giving answers and said that she was disturbed when other students were behaving badly in the class. She told her teacher:

'We should remain silent but those learners are "disobedient". They shout and move around the classroom!'

That day, Mrs Mala, the teacher, informed students that she would use the interactive whiteboard (IWB) to conduct the science class. Most of the students did not pay attention to what Mrs Mala said as they were busy removing their books from their bags. She projected images on 'Air' in the atmosphere on the IWB and asked students to observe the images for few minutes. The whole class went silent and after few minutes, Mrs Mala asked students the following questions:

'Where is 'Air' present?' 'Do you think 'Air' is important?'

Mrs Mala then started her explanation on the topic 'Air.' During this science class, Karen tried to make meaning out of what Mrs Mala was explaining. This could be observed by the pertinent and critical questions that Karen put to check whether

she understood, ‘What will happen if ‘Air’ was not present in the atmosphere?’ ‘Do animals also need ‘Air’ to live?’

She was happy to learn the science concepts through the interactive whiteboard. This could be evidenced by her smiling face. At times, she went into deep reflection, trying to make sense of the visuals and animations in the digitised learning resources. Mrs Mala asked Karen, ‘Can you think of other places where ‘Air’ can be found?’

Karen replied, ‘Hmmm … Give me a few minutes Mrs Mala (her index finger lying on his forehead) … Well, I think air can also be found in the soil for earthworms to breathe.’

Referring to the image in the digital resource showing a fish breathing in water, she said, ‘If the fish gets air from water to breathe, I presume that the earthworms also need air to breathe. Hence, air should be present in the soil as well.’

Mrs Mala replied, ‘Good answer Karen, you are absolutely right.’

Karen was happy and thanked Mrs Mala. She raised her chin with a smile to express her happiness. Mrs Mala continued her explanations by showing a video on the concept ‘Air’. The class turned silent and all students’ attention was focused on the video. While Karen was watching the video, her friend Asha tried to talk to her. She turned to Asha and told her, ‘I’m sorry, Asha. Can we talk later? I really want to learn.’

Karen continued to watch the video attentively. Mrs Mala chose Karen’s friend, Manish to come to the IWB and show the presence of air in the soil using the stylus and he carried out the activity successfully. Manish drew a worm in the soil and wrote, ‘The worm needs air to breath.’

Mrs Mala congratulated him for his effort. Suddenly, Mrs Mala called Karen to the IWB and asked her:

‘Karen, can you now show me the presence of air in water.’

Karen selected the appropriate tools on the IWB using the stylus. She had difficulties to use the stylus to draw but, with the help of Mrs Mala, she succeeded in drawings bubbles of water coming out of the bottle of water indicating the presence of air in water. This showed that Karen had understood the concept but she was not very at ease manipulating the stylus. Mrs Mala congratulated Karen.

'Well done, Karen.'

Before returning to her place, in an air of satisfaction and excitement, Karen told Mrs Mala, 'Madam, it's the first time I'm using the special pen and I'm very happy. It's somewhat like drawing things on my tablet when I play the games I have downloaded.'

Karen then returned to her place and continued to follow the class. Her learning was not limited to what was being taught during the lesson only. She was able to mention other animals living in the soil or water that need 'air' to breathe. On a few occasions, she acted as the teacher and explained the concepts to her friends.

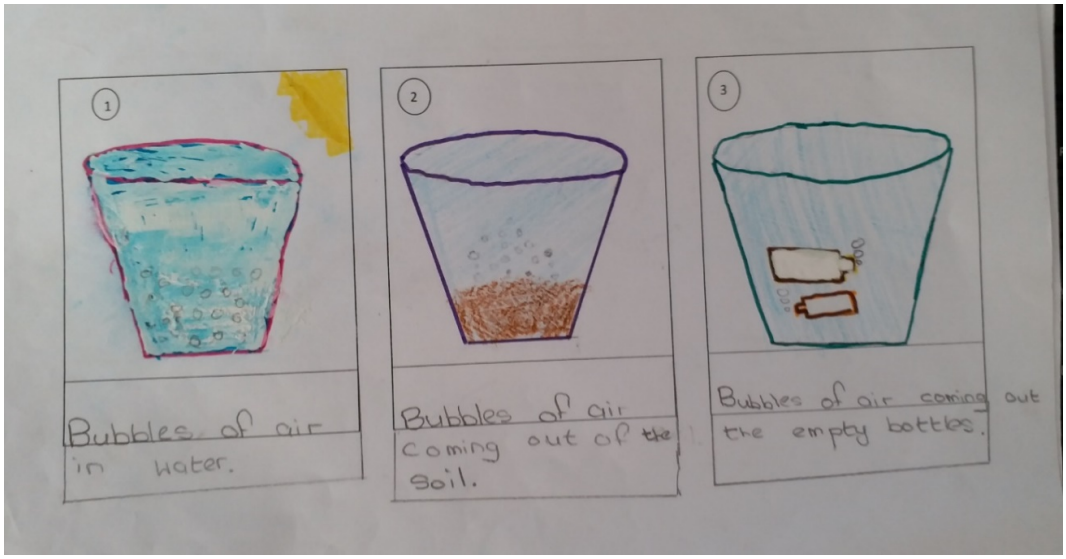
Karen told Mrs Mala that she preferred the IWB as she found it easier to recall the visual representations in the IWB and apply them in her explanations to the class. When Karen was explaining the concept to her friends, she showed that she had developed a thorough understanding of the content. She told her friends:

'Dear friends, as you could recall from the images on the IWB, the bubbles of water coming out of the bottle immersed in the basin of water was not really empty but filled with air. This indicated the presence of 'air' in water.

However, she could not link what she was explaining to other real-life contexts. She only referred to what she had seen in the digitised learning resource.

As for previous lessons done through digitised learning resource, Mrs Mala asked her students to illustrate what they have learnt in three respective grids in a chronological way. Karen once again showed that she was an attentive learner and was able to recall what she had seen in the digital resource. This was

reflected in her drawings as well. Karen's drawings were very simple and clear. She did not place her learning of the concepts in a context.



In the first grid, she drew a glass of water with bubbles of air inside the glass to show the presence of air in water. She drew the sun in the right corner of her drawing but she did not indicate what it represented. She wrote: 'Bubbles of air in water.'

In the second grid, she tried to create a flow in her representations and added soil in the water. She wrote, 'Bubbles of air coming out of the soil.'

In the last drawing, Karen showed that even in empty bottles, air is present. Karen's visual cues were good as she could replicate exactly what was shown in the digitised learning resource. The only difference was that in the resource, the visuals were animated showing the bubbles of air coming out.

Karen could not link what she saw in the digitised resources to her life experiences. Since she was not very talkative in class, she did not socially construct her learning and this was evident in her drawings. She did not discuss what she learnt in the resource with her friends where new insights could have been brought. She limited herself to only her learning of the concept from the digitised learning resource in her drawings. However, her personality was reflected in her drawings, as they were all very neat but without labels. As stated before, Karen was of calm and serious nature. She was also very attentive in

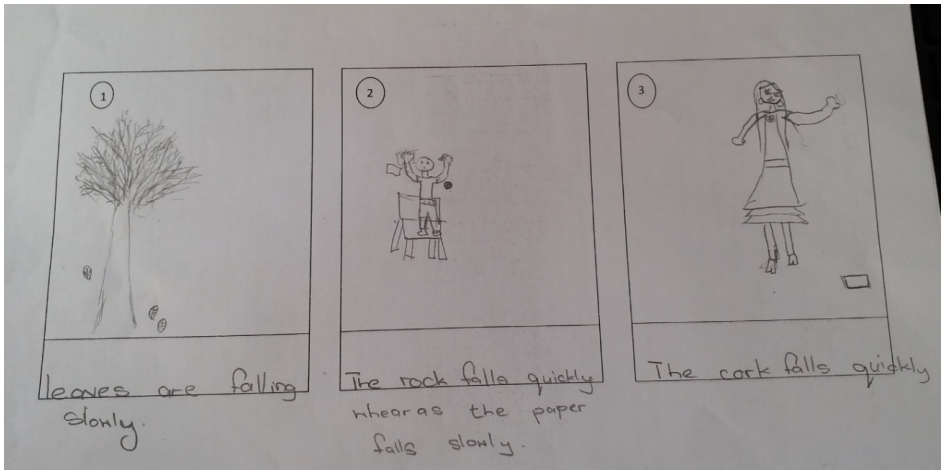
class. In her drawings, she captured the main essence of the concept ‘air’ but did not illustrate her drawings further.

On a second occasion, when Mrs Mala used the IWB to explain the concept ‘Time’, The resource showed several objects falling down and the rate at which the objects were falling were directly proportional to the weight of the objects. Karen told Mrs Mala that she preferred learning through the IWB as the images were lively, allowing her to learn the concepts better.

As summative evaluation, there was drag and drop exercise where students had to identify object falling down quickly and objects falling down slowly. They were asked to drag and drop the objects in the appropriate column. Karen raised her hands and Mrs Mala requested her to do the activity. With a smile on her face, Karen said, ‘Miss, I really like to learn through the IWB as the images seem so real and lively. I also enjoy using the stylus. I feel more confident than last time.’

Besides, Mrs Mala brought few objects and carried out a demonstration on the concept time in class for scaffolding. She focused on attaining the objectives of lesson and she guided the students to think critically on the concepts and relate them to their everyday life examples. Just after the demonstration, Mrs Mala said,

‘Well, students, you now draw what you have just learnt in the grids on the worksheet provided.’



Once again, Karen was very brief in her representations. Karen could elaborate on the concepts neither in her drawings nor in her writing. Despite being very attentive during the whole class, Karen had only a basic understanding of the content and could not engage in higher-order or critical thinking.

The second lesson using the IWB was over and with lots of enthusiasm; Karen asked Mrs Mala, 'When will we learn through the IWB again?' Mrs Mala smiled and replied that she was planning to conduct more lessons through the IWB in the other subjects as well.

5.3 Conclusion

Examining the stories of each participant revealed several ways in which the different learners learnt through the digitised learning resources. It could be noted that a plethora of factors contributed to the ways in which the learners learnt through the digitised learning resources. Examples of these factors revolved mainly around the personality of the learners, the way the teachers mediated the lessons, the experiences that learners had in their environment, the features involved in the digitised learning resource that aroused interest and critical thinking among learners. These factors have shed light on the learners' interest and engagement in different classroom contexts, thus shaping the learners' social identity and learning. The stories also presented the different profiles and attitudes of teachers and learners that had great influence on the ways the latter learnt in the digitised classrooms. It was noted that there were learners who were creative amateurs while learning through their experiences, thereby giving a multidisciplinary lens to learning through digitised learning resources. These learners were able to create their own meaning and representations of the learning within their contexts or frames at the same time. One learner could even relate the concepts he was learning to a movie seen before. In addition, while many learners presented similarities in their learning through the digitised learning resources in specific contexts, the stories indicated that learning was shaped by different stimuli that revealed patterns in their learning. The themes that emerged from the stories will be further discussed in the next chapter to

provide deeper insights into the phenomenon, namely learning through digitised learning resources.

Chapter 6: - Thematic Analysis

6.1 Introduction

In the previous chapter, the short story of each participant was presented. The choice of the first or third person was made to better reflect the data as explained in Chapter 4. It was not an easy task to write in the child's perspectives to foreground how the learner was learning. Nevertheless, rich insights of learning through digitised learning resources were presented by synthesising the data obtained from different sources and putting them in context.

Following the construction of stories, an analysis of the stories is done in this chapter. The stories are unpacked and the themes derived. This chapter is divided into two sections. Section 1 opens up with the themes that emerged from the stories. It also details out how the themes are refined. Themes pertaining to the same category are grouped together and subsequently the themes are further classified into main and sub-themes. The reorganisation of the themes allowed for a more consistent and systematic data analysis process. These themes are highlighted and supported by extracts from stories. The section also includes a cross-case analysis of the themes within each story.

Section 2 presents a résumé of the main findings from the themes. It highlights the main elements that shaped the participants' learning through the digitised learning resources and how the influences of these elements triggered learning in a metamodern era. It also explains how learning is subjective and influenced by several factors within the digitised classroom. The individuality and characteristics of the learners are important attributes that informed learning through the digitised resources. Moreover, insights obtained from this stage of the study allowed the researcher to draw initial conclusions.

6.2 Section 1: Thematic analysis

Engaging in the analysis of the stories, the inductive approach was used as detailed in section 4.5.1.2 in chapter 4. This type of analysis is consistent with Strauss and Corbin's (1998, p.12) definition of the 'researcher begins with an

area of study and allows the theory to emerge from the data'. According to Leininger (1985) and Thomas (2006 p. 238), themes are identified when components or fragments of ideas or experiences are clustered together to create meaning. In this study, the themes that emerged from the subjects' stories were brought together to form a complete picture of their learning experiences through the digitised learning resources. Thereafter, the themes were categorised.

By categorising the themes, different factors that might influence learning through digitised learning resources in a classroom with traditional set-up were identified. A grid was used to match the themes and sub-themes with the data from the different stories. The cross analysis of the seven stories was done in relation to the themes. The different factors that impacted on the learners' learning through digitised learning resources in a metamodern era were noted.

At this first level of analysis, the factors that influenced learning through digitised learning resources referred to as categories were as shown in Figure 6.1:

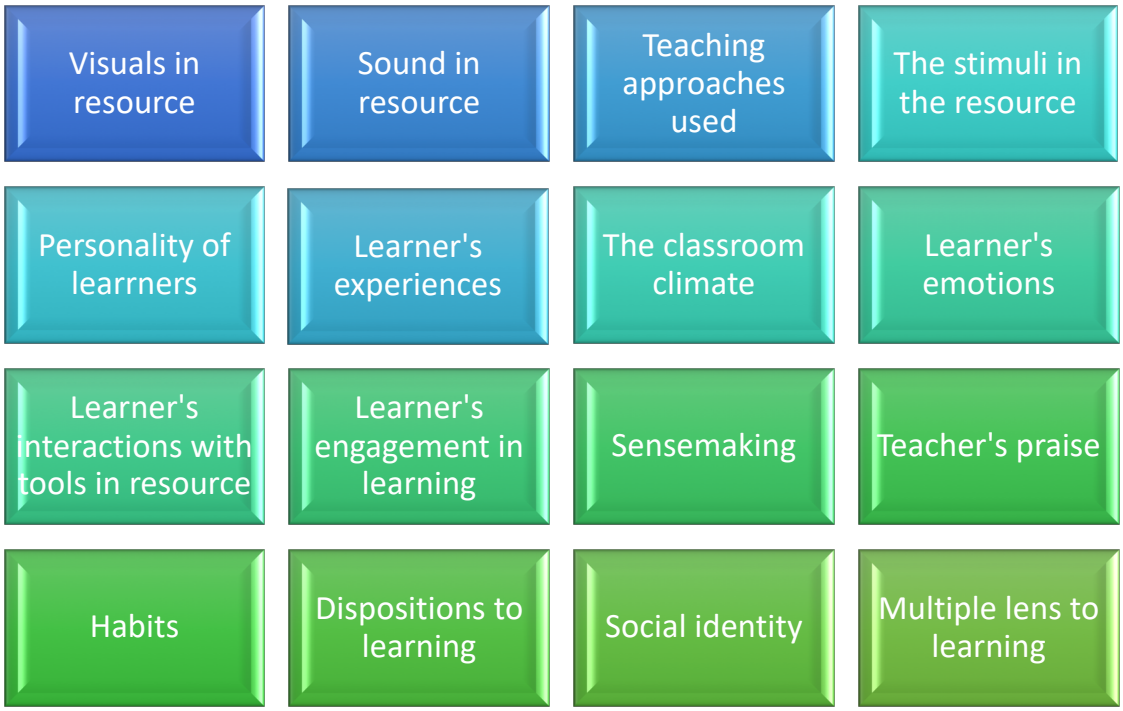


Figure 6.1: Factors influencing learning through digitised resources that emerged from the stories (categories)

Then, the above categories were refined and rearranged into themes and sub-themes, stressing the patterns of influences as presented in Table 6.1:

Table 6.1: Classification of themes and sub-themes from the stories

Organising themes (sub-themes)	Global themes or main themes
Visual cues	Senses
Auditory cues	
Observation	
Emotions	Dispositions
Social identity	
Social interaction	Learning strategies
Self-exploration of tools	
Active learning process	
Logical and sequential representation	
Memorisation	
Meaningful learning	
Self-directed learning	
Teaching strategies	Pedagogical approaches
Teaching methods	
Positive reinforcement	
Connect to life experiences	Association
Connect to reality or hyperreality	
Habits	
Bodily kinaesthetic style	Learning style
Through texts	
Through visuals	
Through narration	

Six main themes emerged from the stories and Table 6.1 illustrates the sub-themes attached to the global themes. The sub-themes that emanated from the main themes provide more in-depth insights into the different ways that the learners learnt through the digitised resources. Now, each factor that affected learners' learning will be analysed through the themes and sub-themes that emerged from the findings.

6.2.1 Senses

In this category, an analysis of how visual and auditory cues affected learning through digitised resources is carried out.

6.2.1.1 Visual cues

In this study, the participants' learning was largely influenced by the visual cues in the digitised learning resources. All the seven participants pointed out that the visuals in the digitised resources helped them to learn and remember concepts better. They pointed out that the visual cues aroused their interest and allowed them to situate their learning within a context. To elaborate on this theme, extracts from different participants' stories are provided.

For instance, Ludy pointed out that she learnt better through the visuals in the digitised resources by referring to animations, which are usually not present in traditional non-digitised resources.

> *'The visuals and animations in the digitised resource helped me to better understand the concepts.'*
>
> (Extract from Ludy's story, p. 161)

Ludy confirmed her views by stating that when the images were moving in a sequential manner, she could understand the concepts.

> *'I could derive meaning from the explanation because I could see the images of the different processes involved in water cycle moving one after the other in the right order.'*
>
> (Extract from Ludy's story, p. 157)

Trisha's views resonated with Ludy's and she claimed that the visuals allowed her to remember the concepts better. She justified her point by saying that the visuals were so 'realistic' that they helped her to remember tiny details. She added that even with low concentration level, she was able to remember details in the digitised resource.

> *'I did not have to concentrate as much as when the teacher explains to understand the concepts and the visuals helped me to remember these.'*
>
> *'In fact, the visuals in the digitised learning resource are so realistic.'*

'I learn better through visuals as I just have to close my eyes and I can visualise what was on the resource. This allows me to remember even minute details in the resource.'

(Extracts from Trisha's story, p. 169, 171)

Going deeper into how the digitised learning resource helped to remember better, Poovani explained that the visuals within the digitised learning resources helped her remember for longer periods. This finding further confirms that the way the visuals were presented in the digitised learning resources impacted a lot on the retention capacity and the interest of the learner. Moreover, it should be noted that Poovani was an average learner and an introvert and the visual cues facilitated her learning.

'The vivid and colourful images aroused and sustained her interest throughout the lesson as could be seen by her eyes that rarely left the display.'

'*I can recall most of the concepts presented through visuals from the interactive whiteboard for a longer period of time*.'

(Extracts from Poovani's story, p. 163, 166)

In addition, Ludy and Raj who were high flyers explained that the visuals in the digitised resources allowed them to connect the concepts to their daily experiences. The digitised resources allowed high flyers to engage in higher-order thinking by applying the concepts to real-life examples. Once more, these two learners referred to the quality of the visuals and animations that provoked them to think beyond what was in the digitised resource and situate themselves in their learning.

'The colourful images allow me to associate the concepts with my daily experiences.'

'It was quite different from our traditional classroom and interesting. It felt like a movie had just started!'

(Extracts from Ludy's story, p. 157, 158)

'He then turned to Johnny and told him that, while he had been watching the video, he felt as if he was the boy in the video, moving around and feeling the air that is present everywhere.'

'He also told Mrs Lizzy that the visual representations in the resource had allowed him to situate his learning within his environment.'

(Extracts from Raj's story, p. 179, 180)

Furthermore, Trisha, Ludy and Karen were attracted by the colourful images which directly or indirectly determined their enjoyment and interest. These observations further revealed that the stimuli in the digitised resources helped the learners to gain the momentum to learn.

'What I mostly liked was the way the images were presented on the IWB. They were very attractive, lively and colourful.'

(Extract from Trisha's story, p. 169)

'These activities are more enjoyable than those we do in our exercise book and the traditional board.'

(Extract from Ludy's story, p. 157)

'Miss, I really like to learn through the IWB as the images seem so real and lively.'

(Extract from Karen's story, p. 188)

However, Krish was of a different opinion. He acknowledged that the visuals were enjoyable but stated that he preferred to learn through the traditional whiteboard. He explained that the images acted as stimuli for his learning, bringing in new experiences but he stated that he remembered better, when the teacher used the traditional whiteboard. Therefore, despite his preference for the traditional board, he admitted that the visuals in the digitised learning resources were indeed enjoyable as pointed out by Trisha and Ludy.

'Even though the images projected are very colourful, interactive and enjoyable, I also like to learn through the traditional whiteboard.'

'When the teacher draws on the whiteboard using the marker, I can remember better.'

(Extracts from Krish's story, p 156)

Furthermore, Ludy gave another reflection of visuals on her learning though digitised learning resources by stating that 'well-labelled visuals' allowed her to clear her confusions. She said that learning through the IWB allowed her to think critically and link to her experiences, thus clearing confusions. She added that each explanation was supported by activities that helped her to check understanding. Therefore, the design elements of the visuals in the digitised resources eased her learning during the lesson.

'In addition, the well-labelled visuals prevented me from confusing the forms and sources of energy.'

(Extract from Ludy's story, p. 163)

For instance, all participants were able to represent their learning through drawings. This outcome was a confirmation that the visual cues in the resource facilitated learning. Karen was a very timid and attentive participant who reproduced exactly what she had seen in the digitised resource, showing her ability to understand and recall the concepts. Besides, Karen also narrated her learning to her peers, referring to what she saw in the digitised resource, which further endorse the power of the visuals in allowing learners to recall facts and make inferences. Hence, it can be noted that 'sight' enables the learner to engage in critical thinking.

'Referring to the image in the digital resource showing a fish breathing in water, she said, 'If the fish gets air from water to breathe, I presume that the earthworms also need air to breathe. Hence, air should be present in the soil as well.'

(Extract from Karen's story, p. 185)

Therefore, these findings indicated that the instructional design in the digitised learning resources had a large impact on Grade 4 learners' learning. They promote learners to think critically and remember better. The visuals prove to enhance the interest of the learners to learn concepts.

6.2.1.2 Auditory cues

The term auditory is used to refer to the sense of 'hearing'. The digitised learning resources comprised animated images supported by different sounds. As explained in Chapter 1 of this thesis, the digitised resources offer more possibilities than traditional textbooks as they can include additional features including audio to promote understanding.

From the findings, the auditory cues also had an impact on the ways the learners learnt through the digitised resource. However, compared to visual cues, only three out of the seven participants stated that the auditory cues influenced their learning through the digitised learning resources. It was observed that when the participants referred to the auditory cues in the resources, they linked them to other features. For example, Pranish stated that the audio in the resource was helpful when it supported the images. He also advanced that he was able to link the concepts with the visuals and his everyday life examples via the 'voice over' in the video. Therefore, the findings of Pranish revealed that the audio influenced his learning only when it was linked to the images and when he was able to make the link to his life experiences. Hence, the auditory cues acted as support to the visuals or experiences.

> *'He added the "voice over" in the digitised learning resource was supporting the different illustrations and aiding him to learn the concepts better and link them to his everyday life experiences.'*
>
> (Extract from Pranish's story, p. 175)

However, Trisha displayed her learning through the audio differently. She did not associate the audio with the images or life experiences but to the approaches that the teacher used in the class. She added that her 'hearing' sense promoted her learning when she was given the opportunity to concentrate fully on what she was hearing from the digitised resource.

'I could hear the sound of the wind in the background during the projection. Mr. Sunil asked us to remain silent, close our eyes and listen attentively to the sound.'

(Extract from Trisha's story, p. 169)

Moreover, Krish displayed his learning through his 'hearing' sense by mimicking the sound he heard in the resource. He did not make any association with either images in the resource or life experiences but stated that the sound that he heard allowed him to attach meaning to the concepts in the lesson 'Air'.

'We could even hear the sound of the bubbles coming out of the funnel. It went like that: blu, blu, blu…'

(Extract from Krish's story, p. 153)

6.2.1.3 Observation

Observation emerged as another main outcome. Three participants claimed that observation aided them to learn the concepts better. They referred to observation of the visuals in the digitised resources which helped them to reproduce their learning in visual forms. Krish and Ludy used the same term to explain that observation was important for learning to take place. They stated:

'The eyes of all pupils were glued to the screen as the images moved.'

(Extract from Krish's story, p. 153)

'Our eyes are glued to the screen as to make sense of the explanation.'

(Extract from Ludy's story, p. 154)

Karen's learning through the digitised learning resources showed that she was able to replicate what she had seen in the digitised resource as she had carefully observed what had been projected on the screen. However, transposing exactly what was shown on the screen to the drawings was not an easy task for her. The visuals and animations in the digitised learning resources were mainly three-dimensional but she had to represent her learning through a two-dimensional drawing on paper. Karen overcame the difficulty/barrier by supporting her

drawings with short sentences, thereby showing that she had understood the concepts.

If Krish's, Ludy's and Karen's stories brought out how observation is vital for their learning, Raj's story showed that observation is not essential for learning to happen through the digitised learning resources. Raj's attention was not sustained when he was looking at the screen; instead, he was always busy sharing his experiences with his peers. By just taking a glance at what was presented in the digitised learning resource, Raj was able to create his own representations of the concepts learnt within his experiences and contexts. This explains that observation might not necessarily be a pre-requisite to learn through the digitised learning resource. The learning style or personality of the learner determined his or her type of engagement with the digitised learning resources.

6.2.2 Dispositions

This category deals mainly with the internal feelings or satisfaction that learners derived while learning through the digitised learning resources. In this study, dispositions are the emotions and attitudes that learners had when they learnt through the digitised resources. It is important to analyse these features, as they were prominent in all the stories.

6.2.2.1 Emotions

From the above discussions, it was apparent that emotions impacted on the learners' learning as they all expressed a feeling of acute interest, motivation and enjoyment when they were looking at the visuals. The terms that were used to express the participants' feelings in the stories were: 'enjoy', 'enthusiastic', 'wow', 'love', 'happiness', 'exultantly', 'youpie', 'smile', 'excitement' and 'fun'.

While narrating his experiences to his mother, Krish brought out the transformation at the level of the classroom context when the learners were told that they would learn through the digitised learning resources. The resource aroused these emotions in the learners. Even though the classroom setting remained the same, the states of mind of the learners were altered. Indeed, the interactions that the learners made with the digitised learning resource created a

positive environment and this largely impacted on the ways they learnt through the digitised learning resources. All the seven stories reveal that the classroom atmosphere changed to a conducive one even before the lesson started.

'Mila shouted, 'Hurrah! This is so nice!'

'And he went on in the same enthusiastic tone.'

(Extract from Krish's story, p. 154)

'We're going to have our science lesson on 'Energy' and we will use the interactive whiteboard.' Instantly the morose faces lit up and all the students smiled exultantly. The class became noisier and students were impatient to get started.'

(Extract from Poovani's story, p. 164)

The happiness was even resonant in Krish's tone of voice and he was disappointed when he was asked to wait for his turn to manipulate the tools on the interactive board. He related his happiness to the different stimuli in the digitised resources and to his engagement with the digitised tools on the interactive whiteboard. However, Krish's joy of learning through the digitised learning resource was not translated into his preference to learn. He stated that he liked what he saw in the digitised resources but still preferred to learn using the traditional whiteboard. Therefore, expressions of joy and happiness in the digitised classroom are not directionally proportional to learning preference through digitised learning resources.

Ludy's emotions of learning through the digitised learning resources was expressed in different ways. She associated her love for school to the opportunities to learn in novel ways. She elaborated by saying that when she was able to manipulate the tools on the interactive whiteboard, her confidence increased. This explained that learning through digitised learning resource arouses positive emotions among learners of eight to nine years old. However, the conditions for these emotions to manifest themselves need to be considered. The embodied emotions of Ludy, for instance, were connected to the manipulation of the tools in the digitised resources.

'We love coming to school because we are often given the chance to experience new and interesting ways of learning.'

'It's amazing!' I thought to myself.'

'These activities are more enjoyable than those we do in our exercise book.'

'I became a little more confident and successfully carried out the activity.'

(Extracts from Ludy's story, pp. 156, 157, 159)

Learning through digitised learning resources aroused her happiness, curiosity and interest to learn the concepts. She described how the lesson became an enjoyable one when the digitised resource was used.

'Before learning through the IWB, I did not have much interest in science. This resource has changed the way I learn.'

'I told my parents about my experiences in the science classroom and how I enjoyed learning through the IWB. I told them how I had been filled with curiosity.'

(Extracts from Ludy's story, p. 161)

Therefore, emotions were one of the most apparent factors that influenced learners' learning through digitised learning resources.

6.2.2.2 Social identity

Findings revealed that few participants created their social identity when they interacted with the tools in the digitised resources. Like Ludy, Trisha and Pranish increased their self-confidence as well as crafted their social identity when they were asked to carry out the activity on the board. Initially, they were both stressed and wanted to carry out the activity on the IWB successfully in front of their friends. Pranish described his state of mind as 'not so enthusiastic', thereby revealing his apprehension or fear of being unable carry out the activity.

'…although he enjoyed that specific science class, he had not been as enthusiastic when Mrs Pim had called him to carry out an activity on the IWB. He said that he was afraid of not being able to carry out the exercise.'

(Extract from Pranish's story, p. 174)

Later however, expressions of happiness were noticeable when Trisha and Pranish successfully did the activity in front of everybody in the class.

'Fortunately, I did it easily and was happy at my success.'

(Extract from Trisha's story, p. 170)

These findings show that Trisha and Pranish wanted to create their social identity in front of their teacher and peers. They were conscious about their friends' opinions when they were asked to carry out activities on the IWB. Trisha admitted that she felt involved in her learning and preferred to learn through the IWB. Hence, creating social identity was a determining factor that eventually shaped the learners' responses when they learnt through the digitised learning resources.

Furthermore, Krish's reactions also show that his interactions were linked to his social identity as he was much concerned about his ability to represent what he learnt through the visuals in a comprehensive way. He was saddened by the fact that he could not complete his drawings. In this case too, his learning through the digitised learning resources influenced his social identity.

'Unfortunately, I could not draw all that I had seen in the video, such as bubbles coming out from the funnel, and I did not have time to colour the drawings,' said Krish in a sad voice.

(Extract from Krish's story, p. 155)

However, Raj's emotions towards learning through the digitised learning resources differed from that of Ludy, Trisha and Pranish. Instead of being conscious or stressed like the other participants, he was open to showcasing his understanding of the concepts. He mimicked what he had seen in the digitised resource to demonstrate his learning. So, the design features in the digitised learning resources affected Raj's learning but in a completely different manner He was able to reproduce what he learnt in his own personalised way. Raj's dispositions to learning may be a result of his personality since, unlike the others, he was an extrovert. It can be noted that he expressed his emotions by sharing

his happiness with his friends or his happiness was contagious as other students also mimicked breathing.

'He took a deep breath to show to Mrs Lizzy that he was breathing the air from the atmosphere. All his friends started to laugh and they imitated Raj.'

'His excitement was obvious in the way he was turning to his right and left to explain what he had understood.'

(Extracts from Raj's story, p. 178, 181)

6.2.3 Learning strategies

The learning strategies refer to the approaches that the learners used to construct meaning out of the concepts taught during the class. As learning strategies within the classroom context, this main category consists of the interactions entailed in knowledge construction, manipulation of the tools on the IWB and active engagement of the leaners within the digitised classroom.

6.2.3.1 Social interaction

Social interactions normally occur when we act and react with people around us. It was noted that the classroom set-up directly or indirectly affected the social interactions of the participants within the digitised classroom. The seating arrangement whereby students were sitting close to each other favoured social interaction.

'The class was crowded and the seating arrangement was such that all the students were sitting very close to each other.'

(Extract from Raj's story, p. 177)

However, when it concerns learning through the digitised resources, not all the participants reacted in the same way in terms of their interactions with their peers. It was obvious that the personality of the learner considerably influenced the degree to which the learners learnt the concepts through social interactions. Krish, Ludy, Trisha and Raj were able to construct knowledge and understanding of the concepts taught through the digitised learning resources by networking with their peers. However, each one of the four participants showed different

patterns of social interactions. Krish constructed his knowledge by sharing his understandings of the concepts with his friends during the class. He did not wait for the explanation to be over. So, for Krish, the resource was the stimulus and the conversation or interaction with his friends acted as the means to shape his learning during the class. Krish self-directed his learning through the interactions with friends as the teacher did not intentionally promote learner interaction in his teaching.

Social interactions also served for diagnostic purposes when learning through digitised learning resources. For instance, Ludy's social interactions served to create knowledge and understanding from what she had seen in the digitised learning resources at the start of the lesson. She interacted with her friends to derive meaning out of the visuals prior the teacher's explanations.

'Now, after Mr. David's explanation, the animation and the discussion with my friend, I understood that clearly.'

(Extract from Ludy's story, p. 158)

Another instance where social interactions changed was when the lesson was over. The purpose of social interactions in this case was to confirm or check understanding of the concepts with peers. Trisha and Raj were the two participants who waited for the class to be over to socially interact with friends. Both were extroverts and they liked to share and narrate their experiences. However, their motive behind interacting at the end of the lesson differed. Trisha was so amazed by the visuals and animations in the digitised resource that she preferred not to disrupt her attention during the class. So, she waited for the end of the lesson to check her understanding with her friends. Nevertheless, for Trisha, social interactions did not largely influence her learning. She clearly voiced out that both the visuals in the digitised learning resources and the teacher's explanations facilitated learning.

'Nevertheless, I always confirm my understanding with my friends after the lesson in order to make sure that I did not miss any important details.'

'By looking at the visuals in the digitised learning resource and listening to Mr. Sunil's explanation, learning the concepts was made easier for me.'

(Extracts from Trisha's story, p. 170)

On the other hand, the visuals could not sustain Raj's attention. He rarely focused on the elements displayed and the teacher's explanation for his learning. During the class, he was connecting what he was saw in the digitised resources to his experiences but once the class was over, he started to chat with his friends. Raj's interactions were not to check understanding like Trisha but to narrate his application of the concepts in a creative manner. Learning through the digitised learning resources promotes metacognition depending on the level and personality of the learner.

'As soon as the video was over, Raj started to chat with Pamela and Johnny.'

'In this class also, Raj was not fully attentive to Mrs Lizzy's explanations. Instead of following the teacher's explanations, he was busy narrating what he saw in the movie to Pamela and Johnny.'

(Extracts from Raj's story, p. 179, 181)

Therefore, social interaction emerges as a factor that helps in constructing and applying knowledge. However, learners also learnt in a passive way despite the use of digitised learning resources. Pranish and Karen were very attentive in class and their learning through the digitised learning resources was not determined by social interactions. However, despite being very attentive in class, Karen represented basic knowledge of the concepts in her drawings. She could not illustrate her drawings in writing. Moreover, Karen could not represent her learning in a context familiar to her.

'I prefer to rely on the teacher's explanations rather than learn from my friends,' said Pranish

'Pranish did not like to discuss with his friends when Mr Paul was using the IWB, as he preferred to pay full attention to Mrs Pim's explanations and to everything, he could see in the resource.'

(Extracts from Pranish's story, p. 174)

This explains that attention of learners throughout the class is not proportionate to learning of the concepts or engaging in higher-order reflections.

6.2.3.2 Self-exploration of tools

Manipulating tools on the IWB is unique when it comes to learning through the digitised learning resources. The findings revealed that the teachers provided opportunities for learners to manipulate the tools to carry out specific activities or exercises. All the participants expressed their enthusiasm to learn by manipulating the tools on the interactive whiteboard. A few students even created their social identity with the effective use of the tools as discussed before. Emotions were always connected to the successful use of using the tools.

Furthermore, the participants were indeed very happy that their learning was not limited to only the concepts in the lesson but also included learning to use the stylus.

> *'As I had dragged the bottle into the basin of water, the bottle had not sunk because it was filled with air. That interactive activity had really been helpful!'*
>
> (Extract from Ludy's story, p. 160)

> *'What was amazing in that class was that I learn the concept and also using the special pen. I have never used such pen in my life before. This is completely new to me.'*
>
> (Extract from Trisha's story, p. 170)

> *'I'll tell my parents that I have learnt a new thing today. I have learnt how to use the digital pen to move words on the IWB!' he told Johnny.*
>
> (Extract from Raj's story, p. 179)

In other words, their learning transcended what was in the official curriculum. They proudly explained that they were able to explore the tools to carry out the activities effectively. Besides, it is noticeable how these positive high emotions derived from learning through digitised resources enhanced the classroom learning environment and interest of the learners.

Moreover, learning through the digitised learning resources corresponds with the philosophy of the NCF (2016), which emphasises holistic development. The learners were able to develop their cognitive skills by learning new concepts and features in the digitised tools. In many cases, the learners were provided with the support of their class teachers to be able to manipulate the stylus confidently and successfully.

'She had difficulties to use the stylus to draw but, with the help of Mrs Mala, she succeeded in drawings bubbles of water coming out of the bottle of water indicating the presence of air in water.'

(Extract from Karen's story, p. 186)

Their ability to manipulate the tools led to kinaesthetic development. Moreover, the affective domain was also catered for as they expressed their happiness and satisfaction about using the tools successfully. Krish and Trisha even declared their dissatisfaction when they were left with few opportunities to interact with the digitised resources.

'I really wanted to use the marker to drag and drop and pleaded for Mr. Steve to send me to the board.'

(Extract from Krish's story, p. 154)

'Unfortunately, the teacher rarely uses the IWB, leaving us with little opportunities to use the pen and interact with the resource.'

(Extract from Trisha's story, p. 170)

6.2.3.3 Logical and sequential representation

When asked to elaborate on their drawings, almost all the participants represented their learning in a sequential manner. Their drawings corroborated with the sequence of the visuals and animations in the digitised resource. It was evident that their learning was guided by the contents of the digitised learning resource and the teacher's explanations. They revealed a logical understanding of the concepts they had learnt. Moreover, the participants were able to narrate their learning at length and in a logical and sequential manner. They happily explained the meaning behind each drawing.

'I have drawn a funnel just like in the video in the first picture. I then drew the funnel in a basin of water with my finger at the top. then drew the funnel in a basin of water with my finger at the top.'

(Extract from Krish's story, p. 155)

However, though Raj indicated a logical sequence in his learning through his drawings, he did not eventually replicate exactly with what was in the resource. Though learning through the digitised learning tool had promoted learning in a chronological way, Raj's learning was of higher level and he illustrated his understanding of the concepts by linking them with his experiences.

'He displayed his acquisition of knowledge and understanding through a scenario and in a chronological way.'

(Extract from Raj's story, p. 182)

Poovani showed that she had understood the concepts in a sequential manner but her learning was limited. Even though her drawings showed that she understood the concepts in a logical manner, she was not able to illustrate her drawings through text. Therefore, learning through digitised resources is directly proportional to the personality and lived experiences of the learners. These determine the depth of the learning and the degree of creativity attached to the learning.

6.2.3.4 Memorisation

The stories showed that memorisation was present whenever learning was done through digitised resources. All the participants claimed that they were able to remember when they had learnt through the digitised learning resources. They connected their ability to memorise with the visuals and auditory cues in the digitised learning resources.

'After the clip, we could understand and remember everything.'

'I reproduced the images that showed the different stages of the experiment on the digitised learning resources.'

(Extract from Krish's story, p. 153, 155)

'All her three drawings were closely related to what she had seen in the digitised learning resource and what has been taught.'

(Extract from Poovani's story, p. 167)

'He also pointed out when he learnt through the IWB, the visuals helped him to memorise fine details of the concepts.'

(Extract from Pranish's story, p. 174)

However, while Poovani and Pranish explained that they were able to remember details of the concepts through the IWB, Krish explained that he remembered better through the traditional board. He oscillated from 'remembering everything' through the IWB and 'remembering better' on the traditional board.

'In fact, when the teacher draws on the whiteboard using the marker, I can remember better. If the interactive projector is taken away from the classroom, it will not really affect my learning,' said Krish.

(Extract from Krish's story, p. 156)

6.2.3.5 Meaningful learning

With the exception of Poovani, all participants had a clear understanding of the concepts in the lesson. Krish stated that he understood the concepts well through the digitised learning resources and his teacher provided him feedback on his learning.

'The teacher saw it and said that I had understood the concepts.'

(Extract from Krish's story, p. 155)

Ludy was able to show her understanding of the concepts by illustrating her drawings with texts. She also gave precision to details in her drawings when she was narrating her experiences of learning through the digitised learning resources.

'In the first grid, I drew a bottle. I wrote 'empty bottle' below but in fact the bottle was not empty. I did so to later prove that the bottle was in not empty.'

(Extract from Ludy's story, p. 160)

However, Poovani showed knowledge construction partially. In the last drawing, she failed to provide sufficient details to match her drawings with the text. She mentioned about the wind vane but did not explain how the wind vane was used to produce electricity. This finding indicated that she had a misconception about function of wind vanes.

Another way the participants showed understanding of the concepts was by successfully answering the teacher's questions. For instance, Pranish could make sense of the concepts and relate his learning to other situations.

'I have learnt that if 'Air' is present everywhere, it means that all animals will need air to breathe.'

(Extract from Pranish's story, p. 174)

However, Raj's learning was revealed through his responses making reference to the images, videos and examples given in the digitised resource. He even reproduced the sound he had heard in the resource to show his understanding. He stated that he learnt the concepts by linking what the teacher was explaining to his experiences. Raj created his own understanding of the concepts, which were beyond what he had seen in the digitised resource.

'Yes Miss, air is everywhere, it allows us to breathe.'

'*Watching this video has really made it easier for me to understand the topic.'*

'As from now on, whenever I will look at animals on trees, on land or under the soil, I will think about this lesson and what I have learnt about "Air"!'

(Extracts from Raj's story, p. 178, 179)

Besides, Raj conveyed his understanding by writing complete sentences below the drawings. His descriptions were not merely a reproduction of what were in the digitised resource. He created his own scenario from his learning and with appropriate illustrations. Raj was very proud that he was able to represent his learning in an original and authentic way although it had emanated from what he saw in the digitised resources. Nevertheless, for Karen, this was not the case, as she reproduced exactly what she saw in the resource. She could not think beyond

what was in the digitised resource. Therefore, this suggests that learning through digitised resources differs according to a child's lived experiences.

6.2.3.6 Self-directed learning

Different participants directed their learning in their own ways. For instance, Poovani and Trisha claimed that they preferred to follow the class attentively to understand and obtain good results. This finding indicates that both Poovani and Trisha were exam-focused rather than trying to explore the different possibilities of linking with their experiences. Raj had a distinct way of self-directing his learning. He did not follow the class attentively but was indeed able to represent his learning in different contexts while referring to the content in the digitised learning resource. As for Karen, she learnt only the main elements from the digitised resource. Her learning was effective but limited as she focused only on the objectives of the lesson. She did not engage in social interaction to develop in-depth understanding of the concepts. The common thread among all the participants was that they were able to narrate their learning precisely and concisely, despite the differences in learning style and personalities.

6.2.4 Pedagogical approaches

In this category, the learners' learning is analysed against the pedagogical approaches that the teachers used in the digitised classroom. The approaches used are determined by the teaching strategies, teaching methods and positive reinforcement.

6.2.4.1 Teaching strategies

Teaching strategies are central consideration for influencing learning through digitised resources. They refer to the teaching plan that the teacher used. For instance, when Ludy stated that when the teacher used the images and the texts in the digitised resource to explain the concepts, she brought out the essence of the teacher's dispositions to implement the curriculum through the use of the digitised learning resources. Though the aim of the participants was to learn the concepts, the teacher's pedagogical choices influenced their learning. Trisha reported that the teacher's explanation eased her learning of the concepts. The

teacher planned and implemented the lesson in a way to promote learner-centredness, thereby giving opportunities for learners to relate to the digitised learning resources.

'At times, Mr. David moves the images on the IWB during the explanation. For example, when he was explaining the topic 'water cycle', he dragged and dropped labels to indicate the different processes.'

(Extract from Ludy's story, p. 157)

'By looking at the visuals in the digitised learning resource and listening to Mr. Sunil's explanation, learning the concepts was made easier for me.'

(Extract from Trisha's story, p. 170)

Few participants explained that the way in which the teacher used the digitised resource prompted/enabled/allowed them to learn actively through the digitised resources.

'Our teacher was not just explaining to us but creating opportunities for us to participate actively in the lesson.'

(Extract from Ludy's story, p. 159)

Interacting with the digitised tools on the IWB also made learning active. Moreover, learning by doing or active learning facilitated the learners' learning. So, construction of meaning through interactions is a result of the teacher mediating the teaching, the learning and the resource.

'Our involvement made learning take place much more easily.'

(Extract from Ludy's story, p. 159)

'…after few minutes, Mrs Mala asked students the following questions:

'Where is 'Air' present?' 'Do you think 'Air' is important?'

(Extract from Karen's story, p. 184)

This explains why few participants deplored the lack of opportunities to interact with the digitised resources when this was noted from Trisha's story.

'Unfortunately, the teacher rarely uses the IWB, leaving us with little opportunities to use the pen and interact with the resource.'

(Extract from Trisha's story, p. 170)

Despite the teacher's use of approaches to promote participation, Poovani preferred to reflect on the questions instead of interacting in the class. So, the teaching approach and the design features in the digitised resource might not necessarily result into active engagement of all the students in the digitised classroom. The personality, learning style or goal of the learner influenced his/her contribution.

'Poovani always followed the lesson attentively to understand better and obtain good results. Indeed, from time to time, she opened her copybook and wrote in few words related to the explanation.'

(Extract from Poovani's story, p. 165)

The analysis carried out so far reveals that the factors contributing to learning through digitised resources did not act in isolation; the factors are at times interwoven to influence the learning process. For example, Ludy attributed her success in learning the concepts to the teacher's approaches, the features in the digitised learning resources and her own interactions with the digitised resources.

'The topic that Mr David was explaining was new and the visuals and animations shown on the IWB allowed me to discover new things or verify things that I did not pay attention [to] before.'

(Extract from Ludy's story, p. 162)

In the same way, Karen explained that her learning was also facilitated by the teaching strategies. However, she linked the teacher's use of the digitised learning resources to the use of realia and everyday life examples to strengthen her teaching.

'Besides, Mrs Mala brought few objects and carried out a demonstration on the concept time in class for scaffolding. She focused on attaining the objectives of lesson and she guided the students to think critically on the concepts and relate them to their everyday life examples.'

(Extract from Karen's story, p. 188)

Pranish's views of teaching strategies influencing his learning of the concepts through the digitised learning resources differed. If Pranish agreed that the teacher used the contents in the digitised learning resources to support her teaching, he also pointed out that she did not use the tools present in the digitised resource while teaching. Therefore, the teacher's limited use of the digitised resource impacted on the depth of Pranish's learning.

'Mrs Pim did not use all the tools or features on the IWB. She just referred mainly to the visuals to support her teaching.'

(Extract from Pranish's story, p. 173)

Raj once again differed from the other participants by his behaviour in the digitised classroom. He did not attribute his learning to the teaching strategies that the teacher used. He pointed out that the teacher did not allow students adequate time to think and reflect critically on the concepts taught through the digitised resources.

'Mrs Lizzy did not allow sufficient time for students to answer and she provided explanations on the visuals in the digitised resource.'

(Extract from Raj's story, p. 177)

Therefore, the findings reveal that teaching strategies that the teacher uses while teaching through digitised resources affect learners' learning in varied ways. The pedagogical choices of the teacher determine the motivation and engagement in the learners' learning through digitised learning resources.

6.2.4.2 Teaching methods

The teaching methods are the techniques that teachers used to attain their teaching objectives. The methods that were observed ranged from teacher-centred methods to learner-centred ones but, in the majority of the cases in this study, the teaching methods helped promote critical thinking and motivation among learners, thereby creating a conducive environment for meaningful learning to take place. For example, Ludy was one of the participants who acknowledged that her confidence had been enhanced when the teacher allowed her to manipulate the tools on the IWB and this allowed her to develop critical

thinking and reflection around the concepts learnt. Hence, learning through the digitised learning resources coupled with the teacher's choice of methods foster critical thinking among learners.

'I must say that learning concepts through the IWB has allowed me to think critically and make links with my life experiences.'

(Extract from Ludy's story, p. 162)

As for Poovani and Trisha, they were of the opinion that their learning was driven by the teacher's use of visuals from the digitised learning resources along with his explanation and questioning techniques.

'I wished Mr. Samy uses the IWB more often as he clearly matches what he is saying with the images and animations.'

(Extract from Poovani's story, p. 166)

Though Pranish acknowledged that his learning of the concepts was enhanced by the digitised learning resources, he did not associate his learning with the teacher's methods. He argued that his teacher's responses to questions were too brief and he could not verify his learning. Instead, he explained that the ways the contents were presented in the digitised learning resources allowed him to think beyond what was in the textbook.

Raj's views were also resonant with Pranish's views with regard to promotion of critical thinking. However, he admitted that his learning through the digitised learning resources was meaningful when he was able to respond to the teacher's questions and carry out the activity using the stylus on the IWB successfully.

'Back on his seat, Raj shared his excitement at having been able to use the stylus to carry out the activity with Pamela, "I'll tell my parents that I have learnt a new thing today. I have learnt how to use the digital pen to move words on the IWB!" he told Johnny.'

(Extract from Raj's story, p. 179)

The teacher's choice of methods thus acquires nuanced significations when defined in relation to the learners' learning through digitised learning resources.

It appears both the teachers' dispositions as well as the learners' dispositions impacted on learning.

6.2.4.3 Positive reinforcement

The teacher's approaches had a causal impact on learning in the digitised classroom. All participants agreed that the teacher's praise and encouragement during the class allowed them to build on their self-confidence and motivation to learn the concepts and manipulate the tools better. Ludy's story of learning through the digitised resource is an apt illustration of how positive reinforcement aroused a feeling of confidence and self-satisfaction that eventually led to meaningful learning.

'Thanks to Mr. David's support, I became a little more confident and successfully carried out the activity.'

(Extract from Ludy's story, p. 159)

Even Raj, who never followed the class attentively, was very happy when he was asked to go to the board. This was evidenced by his happy and smiling face. Moreover, the teacher congratulated Raj when he actually made an effort to translate his learning in an original way.

'Mrs Lizzy congratulated Raj and was very happy. She said: 'Well done my boy, I am very happy that you are able to link what I have just taught to your experiences. It's original and unique.'

(Extract from Raj's story, p. 183)

Raj's self-esteem was enhanced when the teacher later showcased his work to the whole class. This clearly explains the high correlation that exists between the learner and the positive reinforcement. Learning through digitised learning resources undoubtedly allowed the learners to think beyond the concepts taught.

'Mrs Lizzy as well as his friends clapped to congratulate him. Raj was beaming as the claps resonated in the classroom.'

(Extract from Raj's story, p. 182)

6.2.5 Association

It is nevertheless noted that the associations that the learners made between the visuals in the resources and their everyday life experiences or reality are yet another important factor that influenced the learners' learning. There were many instances when the participants displayed the connection they made between the concepts learnt to their experiences.

6.2.5.1 Connection with life experiences

When the projector was switched on, Krish showed his familiarity with such device and declared, 'The projector was just like when the neighbour uses projector to watch movies.' This connection with life experiences aroused his curiosity and interest. He was able to learn through the interactive projector, which he saw in his surrounding but never interacted with. Furthermore, Krish referred to the puzzle games on his dad's laptop when he was asked to carry out the 'drag and drop' activity. His playing on the laptop contributed to his successful manipulation of the tools on the IWB to carry out the activities.

> *'The projector projects images on the board, just as our neighbour Mr. Dev uses his projector to watch films.'*
>
> *'You know, Mum, it's just like the puzzle game I play on dad's laptop'*
>
> (Extracts from Krish's story, p. 152, 154)

Besides, Ludy associated the visuals in the digitised resource with her experiences was of playing with a bottle in her bathtub. She stated that the animations and the sounds in the digitised learning resources allowed her to link what she saw with her lived experiences.

> *'I turned to my friend, Rani, and told her, "It's the same when I dip my small bottle into the bathtub! Bubbles came out from the bottle but at that time, I did not know that it was because of the air that was present in the bottle.'*
>
> (Extract from Ludy's story, p. 158)

Ludy linked her authentic lived experience of immersing a bottle in bath tub to what she saw in the resources. Ludy elaborated by referring to the lesson on

animals and animals in her environment, the lively, 3D-animated contents in the digitised learning resources provoked original and authentic interpretations since personal or lived experiences are unique.

This connection with everyday life examples was also noted in Poovani's drawings. When Poovani illustrated her learning of the concept energy, she drew a cloth line tied to two trees and explained that her mother used to do so. Besides, constructing knowledge and understanding, learning through digitised learning resources allow learners to move to a higher level of thinking.

Furthermore, Pranish and Trisha explained that learning through the digitised learning resources was like watching a movie or video on tablet. Pranish advanced that the background in the videos in the digitised resources allowed him to situate the learning within a context. He was able to evaluate where the concepts were applied and where else they could be applied. Again, learning through digitised learning resources promote higher-order thinking than just basic construction of knowledge.

> *'With much enthusiasm, waving his hands while narrating, Pranish explained that when he looked at the images, he could link them to things in his environment. He added that learning through the digitised learning resources allowed him to think beyond what was written in textbooks.'*
>
> (Extract from Pranish's story, p. 173)

In one set of his drawings, Raj stated that he had linked what he learnt to what he had seen at the animal park 'Casela.' In the other set of drawings, Raj affirmed that he was inspired from a movie he had watched during the weekend. Raj made the connection between what he saw from the digitised resources, the teacher's explanation and what his life experiences. So, once again, the factors impacting on learning through digitised learning resources did not occur in isolation.

6.2.5.2 Close to reality or hyper reality

Krish and Trisha were of the opinion that the images in the digitised learning resources were so vivid that they were close to reality and this allowed them to better make the association with their lived experiences.

'I tell you Mum, it was so real!'

(Extract from Krish's story, p. 153)

'Wow… It's amazing to learn through IWB, the images look real,' I told my dad.

(Extract from Trisha's story, p. 170)

As far as Raj's learning through the digitised learning resources was concerned, he was able to situate his learning within a context that was familiar to him. Raj's drawings differed from other participants' as he presented a whole story to demonstrate his understanding and application of the concepts. Moreover, he wrote complete sentences to illustrate his drawings. He transposed what he learnt in the digitised classroom to a hyper reality by even naming specific characters within the story. He was able to represent his learning in a logical, sequential and creative manner. He explained what was in his drawings by narrating the whole story to his friends and he was so absorbed in his narration that he did not leave out any detail.

6.2.5.3 Habits

It was noticed that Poovani, Pranish, Karen and Krish learnt through their usual habits in the classroom. Poovani and Karen stated that they had to follow the class attentively to understand and pass examination. This is an occurrence in Mauritian classroom that dates back to the 20th century. The seating arrangement being in rows favours specific teaching models and the participants were accustomed to these models. Even though the digitised learning resources promoted social interaction, these two participants were annoyed when their friends wanted to engage in conversations with them. Conversely, Pranish justified his action by saying that, when he followed the class attentively, he was able to remember every detail and respond to his teacher's questions successfully.

'I prefer to rely on the teacher's explanations rather than learn from my friends,' said Pranish.

(Extract from Pranish's story, p. 174)

Krish's learning through the digitised learning resources was completely different from that of others. He was attracted by the visuals and animations in the digitised resources and he enjoyed learning through digitised resources. However, he explained that he preferred the traditional whiteboard as he had been learning through it since early childhood and he was used to it. He associated this preference to his learning habits. He even admitted that he remembered better when the teacher used the traditional board.

'…but I can still learn through the traditional board and the marker because all my teachers have been using them since pre-primary school. In fact, when the teacher draws on the whiteboard using the marker, I can remember better.'

(Extract from Krish's story, p. 156)

6.2.6 Learning Styles

So far, we have been discussing factors that impacted on the learning through digitised resources. In this category, an analysis of the preferred learning styles of the participants is carried out in relation to the use of the digitised learning resources.

6.2.6.1 Bodily kinaesthetic style

Learning through the digitised resources triggered different learning styles among the participants. Krish, Ludy, Trisha and Raj displayed many body movements when they were learning through the digitised resources. They were not able to sit quietly, look at what were shown in the digitised resource and listen to the teacher's explanation attentively.

'"You know, Mum, I'm still thinking about how I was constantly walking to and fro in the science class yesterday!" he laughed.'

(Extract from Krish's story, p. 154)

'I was so curious that I could not remain seated. I stood up and moved around the classroom, asking my friends why the bottle was placed next to the basin.'

(Extract from Ludy's story, p. 158)

6.2.6.2 *Learning through texts*

Representation of learning is usually influenced by the different learning styles. All the participants illustrated their drawings through texts. However, Raj and Ludy were more specific and detailed in their illustrations compared to others. They preferred to show that they understood concepts well by giving details on the concepts learnt and their representations.

'Then I wrote 'the wind is causing the boat to move' below the drawing.'

(Extract from Ludy's story, p. 162)

Nevertheless, Karen was very brief in her explanations. She replicated only what she saw in the digitised resources and could not describe her drawings further. Her learning style did not tend towards writing text to support her drawings and thus influenced her representation of her learning.

6.2.6.3 *Learning through visuals*

The features in the digitised learning resources promoted learners' ability to draw what they had learnt. All participants were able to represent their learning through drawings but the illustrations differed. Ludy enjoyed producing meaningful visuals to represent her thinking. However, she also claimed that it was tedious for her to condense the mass of information from the digitised learning resources into the three grids given.

'I enjoyed that exercise of drawing as it helped me to present what I had learnt in an interesting and creative way!'

'Drawing in the grids was not something simple, as I had to summarise what I had learnt from the digitised resources into the three grids.'

(Extracts from Ludy's story, p. 160, 162)

It could be noticed that Pranish was also at ease representing his learning through images. He was able to apply the knowledge within his context. He drew a horse in the last grid to indicate that the horse gets air from the atmosphere though this animal had not been included in the digitised resources. Moreover, all the participants were able to talk confidently and sequentially about their

learning. As for Raj, he created personalised and authentic series of drawings to illustrate his learning of the concepts.

6.2.6.4 Learning through narration

All the participants were able to narrate their learning through the digitised learning resources in their own specific ways. A few participants were brief while others were very explicit. Once again, Raj's behaviours differed from others. He was excited to present a comprehensive narration of his experiences through the digitised resources and was creative in his narration. He produced a beginning and an end to the story while focusing on the topic of the lesson. This explained his ability to represent his learning through visuals and text in an authentic manner. His narration of the application of the concepts was also detailed and clear.

With an air of excitement, Raj stood up from his chair, put his hands on his waist and said:

> *'Well, this second drawing shows that Batman is driving his batmobile while answering his phone and the weather is very windy outside. The leaves are falling everywhere because of the strong winds. The leaves fall slowly because they are light and they take more time to fall.'*

> *Raj said: 'Well, Mrs Lizzy, in drawing three, I wanted to give an ending to the story and I wrote: 'And batman arrived to the supermarket' just below the drawing. I am referring to the concept 'Time' that I just learnt from the IWB.'*

(Extracts from Raj's story, p. 183)

6.3 Section 2: Entwined influences in the learning processes of the learners

The cross-case comparisons and the thematic analysis from the stories allowed deeper insights into the phenomenon and the possibility to unpack the participants' learning through digitised learning resources. A summary of the emerging insights into the learners' learning is presented below.

6.3.1 Diversity of stimuli in the digitised learning resources

The learning through digitised learning resources cannot be restricted to a sole factor. It is noted that an array of stimuli from the digitised resources determine the ways in which the learners learnt through the digitised resources. For example, the visual and auditory cues were powerful attributes of the resources that led to impactful and enjoyable learning. These features were crucial for learning and retaining the concepts. Numerous learner dispositions (emotions, social identity, self-confidence, etc.) were fostered when they interacted with the digitised learning resources. Moreover, several contextual factors (classroom settings, habits, teacher's approaches, etc.) affected the preferences of the learners' learning, thereby shaping learning in the metamodern era. In a few circumstances, the learners repositioned their learning according to their interactions with the digitised resources and in other situations, learners brought a contour in the pattern they adopt to learn and repositioned their learning. Conversely, Krish's joy of learning through the digitised learning resource was not transposed into his preference to learn.

6.3.2 Emergence of emotions

Positive emotions are attached to learning through digitised resources. The emergence of the emotions occurred even before the class started. At times, novelty fosters emotions. This was evidenced by the change in the classroom atmosphere when the learners heard about the use of digitised resources and by their facial expressions. The stimuli in the resources provoked intrinsic pleasantness among learners, which was sustained. This emotional force lead to action readiness of the learners to manipulate the tools on the IWB. The emotions attached with carrying out the activities successfully on the IWB also synchronised with the social identity of learners, whereby they felt proud. Strong emotions thus drove learning through digitised resources in an affirmative way.

6.3.3 Fuzziness in learning strategies

The themes that emerged from the data reveal that learning strategies have a profound bearing on learning through digitised learning resources within a traditional classroom set-up. However, it is not possible to consider learning in

isolation as it is often linked to the learner's characteristics or personality. The stories of the participants have shown that the learning strategies were intricately linked to the social interactions or other active learning processes. For instance, the noisy classroom environment is an indication of how far the learners become inclined towards social interactions when learning through the IWB. The design features in the digitised learning resources arouse curiosity and interest in the learners, resulting in constructive discussion with peers. There are also blurred boundaries between learners who favoured social interactions and those who did not, despite being in the same classroom context. Furthermore, self-directed learning is another learning strategy that affects positively on learning and remembering the concepts in the lesson. Thus, learners' diverse personality or characteristics significantly shaped the learner's inclination towards learning through the digitised resources and their learning strategies.

6.3.4 Multiplicity of pedagogical approaches

The teacher's pedagogical approach towards teaching and learning in the digitised classroom is also a striking feature in the short stories. Teachers exert their authority in multiple ways to craft their pedagogy. For example, most of the teachers adopted learner-centred strategies to engage learners in critical thinking and reflection. These pedagogical approaches were often combined with the exploitation of the images and animations or motivating learners' interaction with the digitised tools. Pedagogical approaches were insignificant when they were not linked to positive reinforcement in the digitised classroom. The teacher's praises were included in his pedagogy resulting into improved confidence of learners.

6.3.5 Individualised and authentic pathways for learning

While learning strategies appear to bear noteworthy similarities, fine distinctions that surface are from the lived experiences of the learners. Learning cannot be normalised given the variety in learners' life experiences and the manner in which the learners linked the experiences to their learning. The connection to life experiences, reality and learning habits culminate into specific learning behaviours for each participant. Each learner reacted in specific ways towards

learning through digitised resources and these were often geared by their diversity in learning styles. For instance, Raj presented his learning of the concepts through a creative scenario, which he narrated confidently, while Karen just replicated what she saw from the digitised resources. The learning pathways through digitised learning resources cannot be viewed in isolation but have to be associated with the learning styles and varied experiences of the learners. Learning through digitised resources is subjective to the learner's characteristics and experiences.

6.4 Conclusion

This chapter has explained the categorisation of the themes driven from the stories. The themes were then analysed by comparing data from different participants. This further reveals the range of factors that shaped learners' learning through the digitised learning resources. Preliminary findings emanating from this level of analysis revealed that fuzziness in learning strategies and the individualised and authentic pathways for learning were the bases to informing learning through digitised resources. Nevertheless, the influences identified did not act remotely. In fact, the dynamic interactions between the different factors discussed in this chapter impacted on the learners' learning in varied ways. Besides, learners' learning occurred in a specific contextual space where the seating arrangement favoured a traditional approach. Moreover, learners' learning was strongly determined by learners' personal lived experiences and their personalities. The pedagogical approaches also impacted on the learner's learning in the way the teachers mediated the contents in the digitised resources to bring motivation and arouse the interest of the learners. The analysis also reveals that in certain circumstances, learners were limited to very brief responses from teachers, leaving them limited possibilities for critical reflections on the concepts.

The cross-case comparisons were also very revealing. They helped to unfold the fuzziness and multiplicity in the learning strategies through the digitised learning resources. The learning was multi-layered, where the learners did not learn solely about the concepts taught but they were also engaged into subjective

applications of the concepts according to their lived experiences and differed personalities. Having an insight into the factors that influenced learning through digitised learning resources allowed me to better examine learning in the metamodern era within a classroom context that favoured both modernism and postmodernism constructs of learning. The following chapter probes deeper into these findings by focusing closely on what and how the learners learnt through the digitised learning resources concurrently relating to the literature on learning and the antithetical cases. Looking at the phenomenon from diverse lenses will allow me to investigate further about learning through digitised resources in a metamodern era.

Chapter 7: - Discussion of findings

7.1 Introduction

The previous chapter presented a deep analysis of the emerging themes from the stories through a cross-case comparison. The analysis has brought to light common as well as divergent factors impacting on the ways the participants learnt through digitised learning resources. Fuzziness in the learning strategies that the learners had in the traditional classroom context was also revealed. Emotion was a shared feature among all the participants' learning through the digitised resources and it contributed to making each subject's behaviours and representations exclusive. These factors will now be focused on, to determine how the enmeshed factors lead to what the learners learnt and how they learnt through the digitised learning resources in a metamodern era. The findings were different from traditional learning without digitised resources and special attention will be given to that aspect of the findings in this chapter. This will allow for a deeper understanding of the individualised and authentic pathways of Grade 4 learners' learning.

This chapter has five main sections. Section 1 embarks on a discussion of the significant factors that stemmed from the second level analysis, emphasising the antithetical cases. The enmeshed influences are analysed against the existing body of literature and the theoretical framework used in this study. Section 2 presents a rationale for the selection of the untypical cases to discuss the findings. This section also highlights the features that make them diverge from other participants. Section 3 offers a discussion of the findings emphasising the untypical cases to bring out features of learning through the digitised resources in Mauritian primary schools. Section 4 gives a résumé of the insights derived from the discussion of findings highlighting the main binding forces. Section 5 provides responses to the first and second research questions of the study.

7.2 Section 1: Discussing the enmeshed influences of learning through digitised learning resources

In this section, a discussion of the main factors that influenced learners' learning provides an in-depth account of the phenomenon. At this stage, it is important to restate the lens through which the data is analysed. The author examined the data from the lens of metamodernism, which explains the break away, or an oscillation from traditionalism to technocentrism. The themes are also interconnected with analytical discernments on conceptions of learning.

7.2.1 Diversity of stimuli in the digitised learning resources

The findings reveal that the stimuli in the digitised learning resources are very impactful on learners' learning. They arouse the children's senses to promote meaningful learning. They also attract attention of the learners to link their observations to their experiences. Learning through the senses corroborates with Burns's (1995) arguments, which prevailed in the postmodern era. He associated the features in the visuals to heightened stimulation of numerous senses leading to effective learning. In addition, learning through stimulus also accords with the theory of 'classical conditioning' as enunciated by Pavlov (1936) in the modern era, that is response can be conditioned and caused by different stimuli. Thus, learning in the metamodern era constitutes a swaying from postmodern conceptions to modern conceptions of learning. The stimuli in the digitised learning resources provoke interest and readiness to learn (Montessori, 1967) but they are not the only factors that influence learning. The findings reveal that the sense of 'sight' and 'hearing' of the learners are also activated by the teacher's explanation as well as interactions among peers.

Moreover, when the senses actively contribute to learning, they contribute to the overall development of the learners since the learners could observe (visual cues) and listen carefully (auditory cues); the three domains of learning (cognitive, affective and psychomotor) are thus catered for. Bloom (1956) confirmed that learning should cater for these three domains of learning and published revised Bloom's taxonomies to categorise the cognitive processes into distinct levels as illustrated in Chapter 2. Learning through digitised learning

resources provides all learners with the opportunity to develop both lower-order and higher-order thinking skills. For instance, all learners were able to construct remember, understand and apply the concepts; few learners also created reasoning and decision-making skills.

Moreover, the stimuli present in the digitised resources support the three-tier approach (Usher and Edwards, 1999). Firstly, the visuals and animations in the digitised resources allow Grade 4 learners to learn from a multidisciplinary lens. Moreover, the teacher is able to explore the subject matter using an integrated approach. For instance, a brainstorming on the media present in the digitised resources generates productive and creative interactions resonating with the development of 21st-century skills. Secondly, multiple ways of presenting the concepts in the digitised resources challenge the regimes of truth (Foucault, 1980) leading to deconstruction. The learners were able to understand the concepts but with a critical stance as most of them could reply critically to the teachers' questions. Thirdly, features in the digitised resources promoted a visual culture in learners prompting them to view the world from multiple perspectives. These approaches are juxtaposed with each other.

The findings also resonate with Montessori's (1967) arguments, namely that the child becomes more receptive than passive. The features in the digitised resources permit the child to engage in reasoning and create interest in his or her learning (Maunz, 2018).This aligns with the concept of 'conscious learning'. This culminates in the creation of reasoning and decision-making skills.

Furthermore, as stated by Siemens (2005), the use of technology in the teaching and learning nexus helps the 21st-century learner to define and shape his thinking. Siemens (2005) and Downes (2006) referred to the theory of 'connectivism' to explain the learning process within a networked digital world. The stimuli present in the digitised resources allowed five participants in this study to contextualise or situate their learning which aligns with the 'know-how' and 'know-what' supplemented by 'know-where'. Furthermore, acquiring these competencies while learning through digitised resources allows the learners to develop another skill, which is narrating their learning sequentially and

contextually. However, this finding cannot be generalised as the learner's personality, characteristics, habits or culture affect the learner's ability to connect learning to contexts. Participants who are introvert have difficulties in contextualising their learning in their narration. For example, the participant Poovani was an introvert and she reproduced exactly what she saw in the digitised resource in her drawings. She was not able to create her learning in a context familiar to her.

7.2.2 Emergence of emotions

As research in the postmodern era reveals, emotions have a high connection with learning, whereby input cannot be measured with output as postulated by theories of behaviourism. While learning through digitised resources, all participants exhibited positive feelings, which they expressed overtly. They all showed satisfaction when they were called to the board to carry out the activities and especially when they manage to do it successfully. Learning through digitised resources provides learners with opportunities to increase their self-esteem and create their self-identity or social identity.

Creating self-identity aligns with postmodern constructs as learners start to reflect on their self. As discussed in the previous chapter, all the learners were very conscious about their successful interactions with the digital tools on the IWB. They associated their social identity to the use of the digital tools successfully. In other words, the learners are creating their own biographical narratives (Giddens, 2016), which ultimately shape their attitudes to lifelong learning. This association of emotions with identity derived from the interactions with the digital tools is in accord with Erikson's (1968) claim that identity is built at very young age. The identity formation that emerges from learning through digitised resources promotes the development of a 'sense of identity' where the socio-cultural element is a crucial factor. The stories reveal that the ego, personal identity and the social/cultural identity are aspects of development in the child and this aligns with postmodern conceptualisations of learning.

Furthermore, this study informs a structure of feelings through the learning experiences derived from interactions with the digitised resources. The emotions

of the Grade 4 learners that emerged from the interactions with the digitised learning resources are often unplanned and spontaneous. This shows that there is a breakaway from learning in postmodern era where learners had little opportunity to relate with the textbooks, which were not interactive, to enhance their self or social identity towards their peers in the classroom. This oscillation between the traditional ways of learning and the emotions attached to manipulating the tools on the IWB resonates with the concept of 'enactivism' (Van Elk et al., 2010 p. 2) which emphasises the link between self-identity and embodied actions (Thompson, 2007). The emotions bring a new dimension to learning, as all the participants are able to narrate their learning of the concepts (embodied actions) through digitised resources with emotions. The excitement and enjoyment that the participants displayed in the digitised classroom culminate in higher-order skills of narrating learning as revealed in Raj's story.

7.2.3 Fuzziness in learning strategies

Learners have been accustomed to learning through a static whiteboard in traditional classrooms. With the inclusion of digitised learning resources, they have to oscillate between their usual ways of learning and new modes of learning through the IWB. In addition to the teacher and the resource being part of the digitised classroom context, lived experiences add another layer of meaningful learning. The learning strategies connect to the multiple realities and lived experiences of the learners. Therefore, lived experiences from outside the classroom are an influential component that informs learning through digitised resources.

Learning through digitised learning resources presents clearly an alternation from constructs of modernism to constructs of postmodernism. Almost all participants pointed out that learning through digitised resources allowed them to remember concepts better. This finding supports learning through memorisation postulated by Plato and Aristotle in the premodern era. Besides, remembering is also the first level of cognition, according to the revised Bloom's taxonomies posited in the postmodern era. However, the drive of the participants is different from those in the premodern era. Here, the learners do not always view the teacher as an authoritative figure transmitting knowledge. They dedicated their increased

abilities to recall the design features in the digitised learning resources rather than the teacher's explanation. Learning through the digitised resources gives the participants opportunities to engage in discussions and challenge the knowledge that is conveyed to them (Bhamani & Mehar, 2004). They do not assume that their learning is driven by absolute truth or revelation as in the premodern era. This shows a unification of premodern, modern and postmodern constructs.

Another learning strategy that creates fuzziness in learning through digitised resources is when learners are engaged in social interactions. They actually create a diversity of thinking processes that lead to blurriness in their learning. The participants share their understandings and try to create meaning out of their peer's interactions. This attitude of the learners resonates with Giddens's (2016) and Vygotsky's (1978) conceptions of learning in the postmodern era. The participants are no longer followers of tradition but start to question the concepts learnt through interactions. They are viewed as natural collaborators who enjoy discussing with peers instead of absorbing knowledge passively. Montessori (1967) also agreed that the child learns better through peer interactions. However, learning through social interactions was not common among all the learners when the digitised resources were used. A few participants did not engage in social interactions, yet reproduced their learning successfully. This finding confirms Montessori's arguments that the child learns through his or her own interest if the environment is properly constructed. In other words, the child's nature and mental state are not necessarily shaped by the shared cultural space (Bodrova, 2003), which in the case of this study is the digitised classroom comprising the teacher, learner and resource. So, social interaction is a powerful element influencing learning through digitised resources but it is not a determining factor for effective learning through the digitised classroom.

7.2.4 Multiplicity of pedagogical approaches

The pedagogical approaches that the teacher uses to deliver the lesson are important considerations as they inform the learners' learning. The teacher is expected to know how to integrate the use of the IWB in his or her lesson planning. The teaching strategies are used to mediate explanations with the

digital tools. In Mauritian primary schools, the teacher is the authoritative figure having the power to drive the class according to his or her own ideology and approaches. However, it is noted that learners are changing and the teacher has to move beyond the rigid teaching and learning approach. In this study, most learners paid more attention to the visuals in the digitised resources to create meaning rather than listening to the teacher's explanations. Moreover, out of the seven participants, five referred to their experiences with digitised materials in their home environment. This explains the dissonance between the child's acquaintance with technology and the traditional teaching approaches that the teacher use to deliver the lesson. Though the teaching approaches were mostly teacher-centred, the use of the digitised resources stimulated the teachers to engage learners at a certain point in time during the class. The teacher encouraged learners to manipulate the tools on the IWB, which helped to promote several skills in the learner, namely retention capacity, organising ideas sequentially and narrating the idea in a logical and coherent manner.

Learning through the digitised resources endorses Jonassen's (2000) debate around 'learning with technology' emphasising on knowledge construction, explorations and learning by doing. He further advanced that learning with technology supports knowledge exploration through stimulus and this reveals true only when the teacher acted as a guide. In this study, learning through digitised resources also echoes with the teacher's approaches and the stimuli in the digitised resources. In fact, the teacher acting as the guide prevents misconceptions and allows the learners to remain focused on the learning outcomes. Despite the fact that the explanations on modernism, postmodernism and metamodernism are associated with specific eras, this study shows the existence of a dynamic relationship among the three concepts as interpretive systems and philosophical currents (Baciu, Bocoş, & Baciu-Urzică, 2015). This further confirms the oscillation from modernism to postmodernism that prevails while learning through digitised resources. For instance, the learner seeks knowledge from the authoritative source, which is the teacher, as postulated by Plato and Aristotle in the premodern era (Bhamani & Mehar, 2014). The teacher then puts questions that guide the learning, which is a construct of postmodern

era. Finally, the teacher mediates the teaching and learning process using the digitised resources (Duffy & Cunningham, 1996), a construct of postmodern era.

However, the findings do not corroborate with the cognitive tools approach where technologies are given to learners to empower them to gather, organise and analyse information (Reeves, 1998). The teacher acts as the facilitator to guide learning even through technology embedded in the classroom. Indeed, the teacher is not the only expert as expertise is distributed throughout the classroom during the interactions.

Another pertinent occurrence in the stories of the participants is the impact of positive reinforcement on the learners' motivation to learn. All participants stated that their self-esteem was boosted when the teacher encouraged them to carry out activities using the digital tools. This finding vibrates with the theory of operant conditioning formulated by Skinner (1950) in the modern era where behaviours are associated with rewards leading to desired outcomes. Many participants stated that they are able to do the activity correctly only when the teacher praised or encouraged them. Their self-esteem was heightened when the teacher motivated them. The findings present metamodernism where the teacher's positive reinforcement allows the participants to move in a given position and pull back to diametrically opposed position. However, the encouragement is not the only factor that allows effective learning. Learners have to deconstruct and construct their own understanding of the digitised tools to be able to do the activity on the IWB.

The multiplicity of pedagogical approaches used in the digital classroom also culminates in the development of critical thinking among the learners. So, learning through digitised resources promotes development of 21st century skills as explained in Chapter 1. This finding accord with postmodern arguments that truth and identity are not fixed. Learner have to deconstruct their usual way of learning to critically think about how to interact with the digitised resources. This results in a change in thinking and a change in self-identity to becoming a reflective learner.

Furthermore, the neat learning styles or preferences proposed by Kolb (2005) being concrete experience or active experimentation, do not harmonise with the findings of this study. The role of the teacher also changes at several instances when teaching using the digitised resources. He alternates between the 'motivator', 'expert', 'facilitator', and 'provider of opportunities' resulting into diverse behaviours and attitudes of learners in the digitised classroom. Hence, a new type of learner emerges and he/she lies between concrete, reflective and active learner. Moreover, this study adds another element to research referring to learning styles and types of learner, where learning through digitised resources leads to a 'narrativised learner'. This type of learner is able not only to understand, reflect and act but also to narrate the learning with the correct rules of narration.

A further analysis of the Grade 4 learners' learning through digitised resources indicated that the learners oscillated between Montessori's and Vygotsky's views of learning. At times, the discovery learning emerged from the child's readiness and interests and later the assisted discovery manifested itself through formal instructions from the teacher. The three main elements that contributed to these forms of learning were the features in the digitised resources, the characteristics of the learner and the pedagogical skills of the teacher. The teaching methods were actually proportional to learning styles of the learner. Mauritius being a multi-racial society (explained in Chapter 1), the learners' cultures and background differ; but in this study, these did not impact largely on the learning styles of the learners. The only aspect that influenced learning through digitised resources was the 'access to technology' beyond the classroom. Therefore, understanding learning styles acts as an intermediary that informs learning through technology.

7.2.5 Individualised and authentic pathways to learning

Pathways to learning through digitised resources are varied. Each learner has a unique way to learn and this finding resonates with 'metamodernism', which celebrates diversity, difference and multiple subjectivities helping the learner to shape his or her individual as well as collective identities (Hashim & Puadi, 2018). With the proliferation of technology in one's life, the demands in the job market

have changed. It requires development of other skills rather than just cognitive skills as in the modern era. There are participants that construct and deconstruct the concepts to gain understanding whereas others just create their own representations. The learning through digitised resources shows constant fluctuation from modernism to postmodernism, arriving at oscillations deciphered in metamodernism. Here also, metamodernism in viewed as a non-stop and a 'constant repositioning'.

The different pathways that the learners adopt when they learn through digitised resources are related to their beliefs, attitudes, and desires and many other 'micro narratives' declared in the postmodern era. However, these conceptions are repositioned to respond to the current cultural mode where the technology has invaded the lives of people. The idea of faith, trust, and sincerity has resurfaced and transcended the postmodern irony and detachment (Yousef, 2017). Moreover, the development of these personality traits does not occur in isolation but in relation to the characteristics or personality of the learners.

The research reveals that learning through digitised resources is an 'active learning process' (Berkeley, 2018). The learners construct their knowledge based on their prior knowledge, which coincides with Bruner (1967) conceptualisation of learning in the postmodern era. Nevertheless, six out of the seven participants are able to situate their new knowledge within a context familiar to them. This finding supports the theory of constructivism and enactivism, and constructs of postmodernism where the focus is on knowing rather than knowledge. Learning represents a societally accepted reality or objectivist reality but the world is not structured and the digitised learning resources help in structuring learning to 'mirror reality' where the contexts of each learner vary. The differential exposure or experiences thus lead to multiple representations of learning or individualised and authentic pathways to learning. This brings back to the debate that truth is not fixed and applied to different individuals equally.

The individualised pathways to learning also emerge from the concept of associative learning (Spanella, 2018) which a conception of learning in the

modern era, which means that the ideas strengthen each other when they can be connected to one another (Spanella, 2018). The participants associated their learning to their home environment, habits or lived experiences. The postmodernity also referred to as ‘new times’ indicates challenges to the educational practices. The 21st century learners display a multitude of experiences and the advent of technology in their lives is perhaps one of the major contribution to the new learning experiences. The findings conform to Dau (2001) assumptions that technology may transform social relations and provide new means of communication and learning. The extensive exposition of the young learners to technology and their varied contexts result in new patterns of cognitive growth informing varied pathways to learning.

A deeper analysis of the personalised pathways that the participants chose to learn through the digitised resources accords with their preference in their ways to learn. All the participants created their knowledge through transformation of experiences. Unlike the 20th-century scholars’ theories of learning, not all learning through digitised resources is conceived as a process and not an outcome. There were many cases where learners present an elaborate understanding of the concepts through their outcomes and not the learning processes. Therefore, the findings of this study reveal that there is no strong bond between the learning process and outcomes when learning occurs through digitised resources. However, the viewpoint that all learning is relearning stands true, as learners no longer consider knowledge transmitted to them by the teacher as unquestionable as in the premodern era and modern era. In fact, learning through digitised resources is the process of creating knowledge in authentic ways.

Another remarkable outcome in this study is that learners create and recreate the information in varied ways. The findings support the ideas of Montessori’s ‘self-directed activity’ and ‘hands-on’ (Cossentino, 2006) where the learners are given the opportunities to direct their learning in their own ways. The outcomes of this study to an extent align with Gardner’s (1978) theory of multiple intelligences where the learning styles influence the learner’s learning. However, it was observed that the learning style of learners worked concurrently in the digitised

classroom. For example, the interactions in the class can be both interpersonal and intrapersonal. Interpersonal is mainly for creation of social identity and intrapersonal is for self-reflection on the concepts learnt. Moreover, the context also impacted learner's learning. For instance, the classroom setting still being arranged in the traditional way was not conducive for learners to acquire certain skills effectively when learning through technology. Since the seating arrangement of the learners was in rows (shown in Chapter 1), the interactions between the teacher, learners and the digitised resource were fully promoted.

7.3 Section 2: Justification of the three participants as antithetical cases

Working with common themes allowed me to work towards generalisations. However, the findings revealed diverse behaviours and attitudes of Grade 4 learners' learning through the digitised resources, thus persuading me not to typify the learning. Each learner having a specific personality and unique experience led to individualised pathways towards learning through the digitised resources. To fairly reflect the diversity and authenticity in the learning, the researcher chose to focus on the 'untypical' cases to arrive at a deep analysis of the phenomenon in context and to represent the multiple reality. The 'untypical' here refers to the learners whose data demarcated from the rest of the participants by their nature of interactions within the digitised classroom. The three learners who form the antithetical cases are Raj, Karen and Krish. Nevertheless, all these three cases learnt the concepts successfully through the digitised resources, but at different levels.

7.3.1 Raj

Raj was a participant whose learning through digitised resources deviated most from all the other participants. His story provides an alternative view towards learning. It demonstrates how meaningful learning can emanate from unpredictable forms of lived experiences. Raj brought a completely different dimension to learning through digitised resources. His story forces us to consider the major influence of learners' experiences of learning in the metamodern era. The conceptions of active learning in the postmodern era discussed in Chapter 2

are being revisited with Raj's authentic way of representing his learning through digitised learning resources.

7.3.2 Karen

How can one follow the class attentively making sure not to miss any information from the digitised resource and the teacher's explanation, yet cannot represent her learning explicitly? Karen's ability to remember details from the visuals and animations in the digitised learning resources was poor. Unlike other participants, she did not contextualise her drawings. There was a dissonance between the way she behaves in the class and her performance, including the product of her learning. She is a high flyer and an attentive student but she is not able to situate her learning. Nevertheless, she admits that she loves to learn through the digitised learning resources, as the images are like real and lively.

7.3.3 Krish

Krish's story gives us a glimpse of specific attitudes towards learning which are beyond the digitised classroom context. Krish's interactions through the digitised resources do not resonate with his preferred way to learn. On one hand, he projects that he enjoys learning through the digitised learning resources. On the other hand, he points out that he prefers to learn through the traditional whiteboard as he is used to learning through it since early years. For Krish, at the same time, learning can be enjoyable and yet no emotional bonding or preference attached.

The stories of Raj, Karen and Krish that prompts different forms of learning, are used to discuss the hazy peripheries at differed levels: usual/unusual contexts; emotions/habits; learning strategies/learning outcomes; teaching strategies/ meaningful learning; experiences/individualised pathways to learning.

7.4 Section 3: Discussion of findings with respect to the antithetical cases

7.4.1 Case 1: Raj – Create and situate learning beyond reality

7.4.1.1 Self-actualisation and deconstruction of hierarchies

Raj's learning through the digitised resources is fuzzy and not neatly arranged in cascading ways as proposed by the revised Blooms' Taxonomies (Bloom, 1956). He does not pay careful attention to the stimuli in the digitised resources and the teacher's explanations. Nevertheless, he is able to derive meaning of the concepts and at the same time assemble all the information from the digitised resource to actually create his own authentic representation of his learning. Raj is engaged in lower-order thinking and higher-order thinking in parallel when he learns through the digitised learning resources. According to Revised Bloom's Taxonomies (Anderson, Krathwohl, Airasian, Cruikshank, Mayer, Pintrich, Raths, Wittrock, 2001), acquiring lower-order thinking skills is when the learner is able to remember, understand and apply the knowledge whereas the higher-order thinking skills is when the learners is also able to analyse, evaluate and create. For the case of Raj, the knowledge exploration is represented through blurred boundaries between the development of lower-order skills and higher-order skills. Moreover, stimuli may not always be present for learning to happen as Raj self-actualises his learning by simultaneously constructing and creating knowledge at the same time.

Figure 7.1 is a diagrammatic representation of how learning through digitised learning resources is still logical but not necessarily sequential in cognitive levels of development. The blue oval shape represents the lower thinking skills, which coincide with the higher-order thinking skills (in yellow) during learning. The arrows indicate the blurred boundaries between higher-order and lower-order thinking while learning through digitised resources. The learners can understand and at the same time create their own representations. They need not follow the stages in a hierarchical way to attain the higher-order skills in their learning through digitised resources.

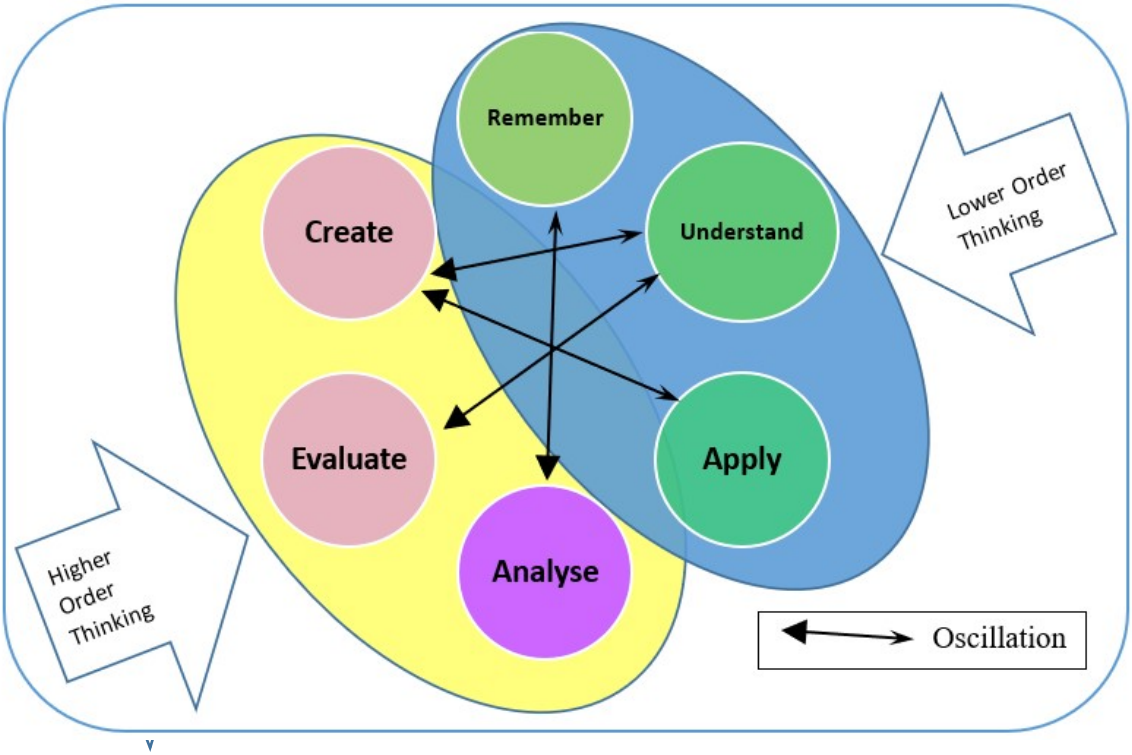


Figure 7.1: Blurred boundaries between lower-order thinking and higher-order thinking

7.4.1.2 Creation of new social identity

Raj's data confirm Warnock's (1976) arguments that emotions are involved when words are converted into images. Raj is able to generate his own images from the contents from the digitised resources that result in enriching his learning. However, Raj's learning opposes the claims of Gardner et al.(1978) that pre-school learners have greater ability to complete a metaphor as this forms part of their environment and interest. Raj shows that he has the readiness to engage in creating metaphors out of his learning through digitised resources, even at eight years old. So, the data confirm that through the use of cognitive tools theory (Egan, 2001), derived in the postmodern era, the child's imagination is addressed engendering creative and concrete thinkers rather than absorbing knowledge passively as in the premodern and modern era.

As for Raj, his emotions are attached to a movie that he watched during the weekend and this impacts a lot on his learning of the concepts and his output. Moreover, Raj's behaviour corroborates the theory of 'associative learning'

(Spanella, 2018), where learning occurs as a connection between events and environment. More eloquently, learning in the metamodern era leads to a return to meta narratives, which are behaviourism, cognitivism and constructivism. The analysis of Raj's findings about his emotions allows the researcher to discover new forms of learning which differ paradoxically with views of the use of technology in the postmodern era. Here, the emotions associated with learning through digitised resources result in creation of new social identities in the class. Raj becomes a creative amateur, as he is able to narrate and represent his learning through digitised resources in an authentic manner.

7.4.1.3 Hyperreality

Raj's story bears a different testimonial and does not attribute much importance to the teacher in the digitised classroom context. Raj connects to his lived experiences outside the digitised classroom to learn the concepts better. So, the digitised resources contain stimuli that promote learning but this might not necessarily be accompanied by the teacher's explanation.

The sense that Raj makes with the contents in the digitised resources is consonant with the concept of hyper reality. The visuals and the voice-overs in the digitised resource allow meaningful learning and empowered Raj to create his own way of presenting his knowledge. As pointed out by Robinson (2012), Raj's drawings refer to situations, which do not relate to precise social reality where the distinction between the real and imaginary is blurred.

The findings reveal that Raj already had a 'theory in mind' (Goswami & Bryant, 2007) and he tried to structure his learning through narration of an original scenario. Raj's representations of learning through 'batman mobile' is also a metacognition while showing memorisation and understanding of the concepts through the detailed illustrations of his drawings. So, there was an oscillation from memorisation which is a conception of learning in the modern era to own construction of knowledge from experiences which accords with Vygotsky's (1978) and Dewey's (1938) conceptions of learning in the postmodern era. This oscillation from absolute truth of knowledge acquired to hyper reality reveal a new conception of learning in the metamodern era. So, learning through the digitised

resources in the metamodern era happens unsystematically and in parallel with or without the teacher being the facilitator. Therefore, learning in the metamodern era is fuzzy and linked to hyperreality whereby the learner creates his own representation of his learning in an original and authentic way.

7.4.1.4 Naïveté and originality

Moreover, Raj's data confirms the presence of naïveté and originality in the child's world (Berc, 2018). The digitised learning resources arouse creativity and curiosity in the learners and allow them to express their creativity in their own personal way. This finding confirms Berc's (2018) assumption of meaningful and enjoyable learning resulting in creating wonders from what the child can see. Furthermore, in metamodern era there is an emergence of opposed combination of 'traits' which oscillated between real and imaginary. Learning through digitised learning resources in the metamodern era is an outcome of the reconstruction or deconstruction where learners become creative amateurs with contour in their patterns of thoughts. The drawings of Raj show paradoxically opposed combinations of 'traits' as the scenarios showed both cynical reality of adults and childlike naïveté just as in movies. The learning of Raj contrasts modern and postmodern dualities. Moreover, the data show that anyone can create and the notion of 'expert' is deconstructed. In other words, the multiple influences in the digitised classroom result in the learner self-directing his own learning. Furthermore, creation is interdisciplinary and multidisciplinary (Kadagishvili, 2013) as Raj is able to draw, narrate and write about his learning while learning the concepts. Hence, Raj's learning is on knowing rather than knowledge.

7.4.1.5 Structure of feelings through lived experiences

Raj is a typical type of learner as his behaviours towards learning through digitised resources are largely deviant. For him, all the credit of his learning through the digitised resources goes to his lived experiences. Nevertheless, he only agrees that the teacher gives him opportunities to manipulate the digital tools. He expresses his concern about the time interval that he is given to actively engage with the resources being too limited. His learning attitudes substantiate the concepts of experiential learning enunciated in the postmodern era where the

focus is on individual differences rather than uniformity in thoughts and practices (Park, 2018) as in the modern era. Besides, as posited by Dewey (1938), people learn best through experiences and this is confirmed in Raj's data. Moreover, the teacher is no more viewed as the sole repository of knowledge (Freire, 1999) and the learner manages his own learning in his own personalised way. The digitised resources help in raising awareness of learners and deconstructing taken-for-granted knowledge as proposed definition of postmodernism by Giroux (1983). The integration of the IWB in the classroom is one of the options that helps the learner to reflect and direct his or her learning. However, this cannot be generalised to all learners as learning styles and personality of learners affect learning.

7.4.1.6 Becoming a creative amateur

Raj takes the initiative to create his own narrative of his learning instead of the teacher acting as a guide and allowing the regimes of truth to evolve. Normally regimes of truth evolve according to who has the power to make them shift and here Raj has this power. This coincides with the concept of deconstruction enunciated by Derrida (1974, 1978) which means going beyond the evident meanings and underpinnings of social phenomena. So, learning through digitised resources in the metamodern era is not a total rejection of postmodernism but presents a contour in the pattern of cognitive growth. Learning is regarded as 'consciousness erasing', the learners create consciousness of their own learning, thus becoming a creative amateur. This also concurs with Tapscott's (2009) views that learners in the metamodern era mainly crave freedom of choice and make their own simulations of their learning. The learner adheres to the metamodern logic explained in the revised Bloom's taxonomy but adds a new dimension to the process of learning as he or she has more specific roles of mediating learning across the digitised resources, the teachers and the peers. Hence, learning becomes authentic and personalised as evidenced in the outputs.

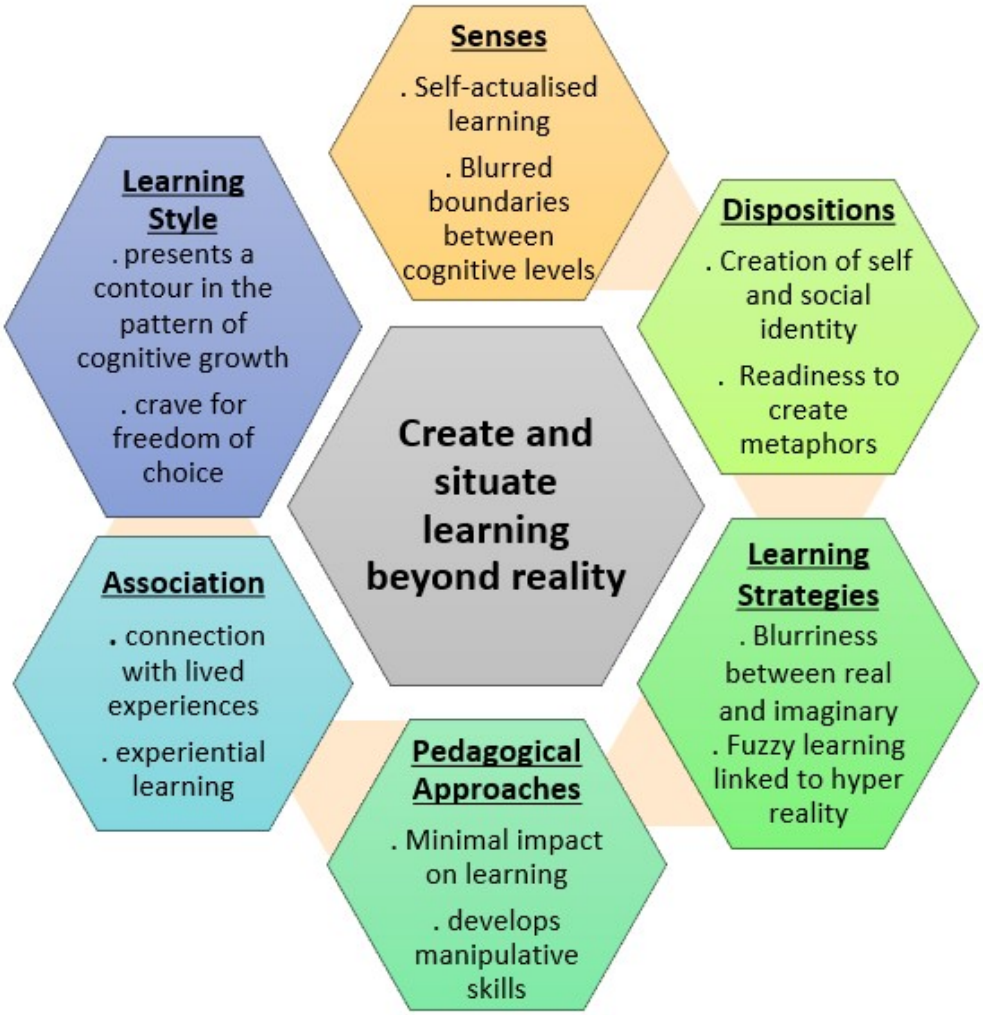


Figure 7.2: Interlocking factors informing Raj's learning through digitised Learning resources

7.4.2 Case 2: Karen- Need for sense

7.4.2.1 Sincerity

Unlike Raj, Karen's learning reveals the opposite. Karen confirmed that she likes learning through the images from the digitised resources as they were very close to reality. However, her drawings dissociate from her claims. Her drawings indicates that she is able to construct knowledge on the concepts taught but cannot move to a higher-order thinking. Karen's learning is restricted to only remembering, understanding and applying the knowledge in her drawings. She is able to apply the knowledge critically and make inferences but cannot evaluate

or situate the knowledge construction through her own creation. In other words, the stimuli in the digitised resources do not promote Karen to higher levels of cognition contemplated in Bloom's revised taxonomies. The irony in the case of Karen is that she is an attentive learner. So, this explains that the attention of the learner towards the stimuli in the digitised resources and the teacher's explanation does not directly influence his or her learning through the digitised learning resources. Hence, the stimuli in the resource prompt enjoyment in the learning but not necessarily higher-order thinking in the Grade 4 learner.

7.4.2.2 Sincerity vs irony

Karen has a timid personality. She rarely engages in interactions for learning. For her, the digitised resources are for informative purposes, which explain her willingness to pay attention to every detail. Karen's emotions are driven by her ability to remember and critically think about the concepts in the lesson. Her reactions partly confirm Burns' (1995) conception of learning being a relatively permanent change in behaviour including observable activity and her internal processes such as thinking, attitudes and emotions. Burns (1995) viewed motivation leading to a desired outcome. However, the emotions or motivation attached to learning through digitised resources does not essentially result in a desired outcome. The visuals in the digitised resources stimulate learning but do not necessarily ensure effectiveness in the learning. There is a somewhat naïve return to sincerity of modernism where knowledge was regarded as the absolute truth. Learning through digitised resources provokes critical reflections but may not always extend to a higher level of thinking. Learning is not fixed and does not have a structure.

This output is an eye-opener, helping the researcher to understand that emotion is a crucial factor influencing learners' learning, especially Grade 4 learners. However, this finding cannot be generalised for learners of different age groups. Going deeper into the analysis, learning in the metamodern era is not a total rejection of the past as even in traditional classroom, emotions existed. Classrooms equipped with digital contrivances allow learners to construct their knowledge and identity through their emotions.

7.4.2.3 Unifying modernity's sincerity and postmodern irony

Karen is one of the subjects whose learning was not promoted through peers' interactions. Karen's identity is not interchangeable and subject to social pressures as argued by postmodernists. She attaches her goals of learning to pass examinations. This is somehow driven by traditions or constructs of modernism whereby learners listen carefully to teacher's explanation to answer the questions. Despite being in the metamodern era, Karen still considers the contents of the digitised resource as the ultimate truth and reproduced exactly the same in her drawings, again resonating with learning in the modern era. Karen has to shift her way of processing information from what she has been trained to do since early years in a traditional set-up to an array of dominant features in the digitised classroom. This finding supports Vermeulen and Van den Akker's (2010) conceptions of an amalgamation of modernity's sincerity and postmodern irony. Karen is loyal to her usual way of learning but this is an irony in postmodern era where social interactions gain ground. The dualities that co-exist explain learning in the metamodern era.

7.4.2.4 Modernity's need for sense

For Karen, the teacher's explanations are crucial for her learning. She admits that she learns better when the teacher uses realia to consolidate the concepts taught. For her, the link that the teacher makes between the visuals in the digitised resources and reality influences her learning. This finding again resonates with Pavlov's theory of classical conditioning where the realia, the visuals in the digitised resources and the teacher's interventions act as stimuli. Her characteristics as a learner also influence her learning, as she is an attentive learner who constructs knowledge on the teacher's explanations being considered as the ultimate truth. She is not the type of learner to bring a rupture from modernism and be a creative amateur. Karen makes sense of the concepts by the way the teacher mediates his teaching using the digitised learning resources.

7.4.2.5 Blurred boundaries between real and imaginary (no hyperreality)

Learning through digitised resources is in fact twofold. On one side, learners can create original representations of learning and on the other hand, learners may restrict themselves to the construction of basic knowledge. An oscillation exists between learning in the modern and postmodern era within the same context. Numerous factors lead to this way of learning. The first one is the personality of the learner, which is the case of Karen. Karen prefers her freedom to act individually rather than collectively. So, in the case of Karen's learning through digitised resources, grand narratives that claim objective meanings and true interpretations are at odds with postmodernism. Her blurred boundaries between real and imaginary was not linked to hyper reality but to her own internal mental structuring of the concepts learnt through the digitised resources and the teacher's explanations.

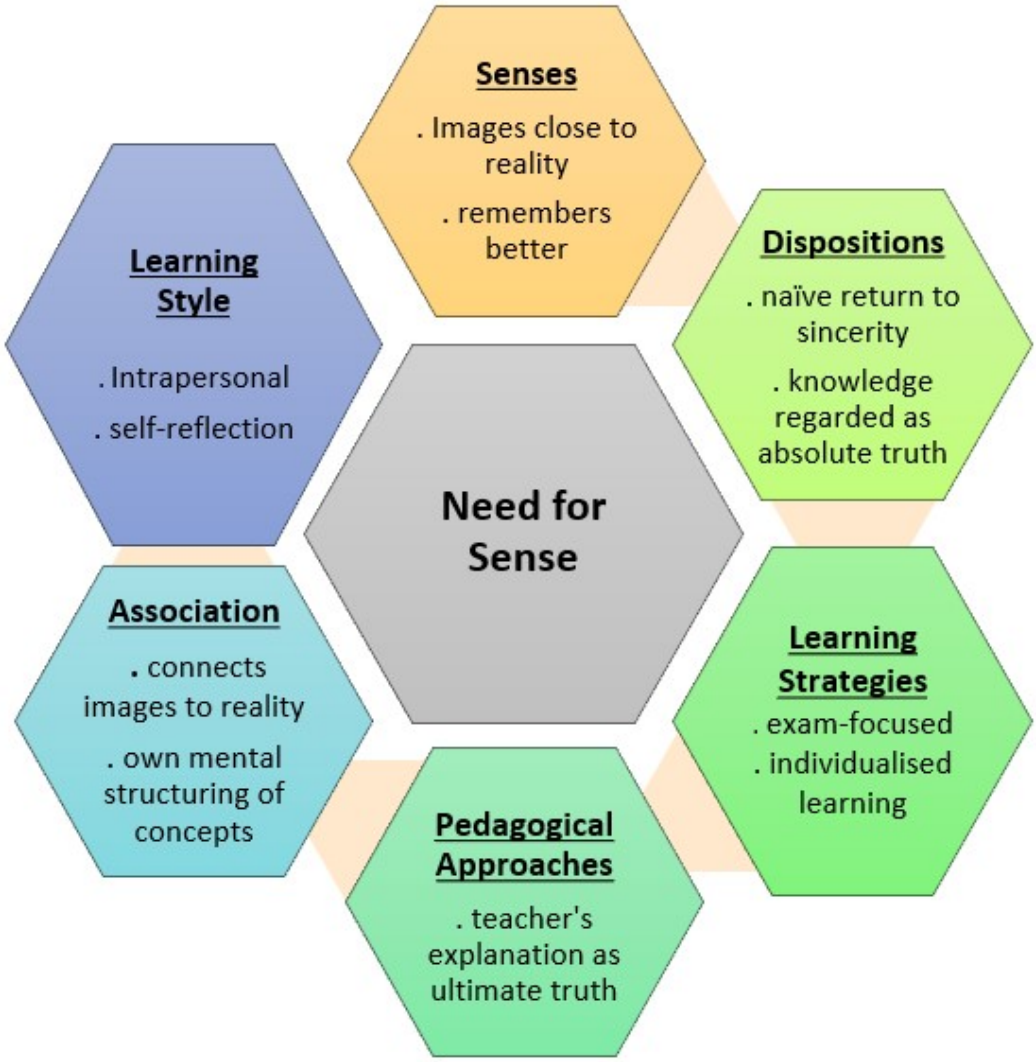


Figure 7.3: Interlocking factors informing Karen's learning through digitised learning resources

7.4.3 Case 3: Krish – sincerity and irony

7.4.3.1 Patterns of cognitive thoughts

Like other participants, Krish also explained that the visuals and animations in the digitised resources aroused his interest in learning. However, he does not associate his retention capacity to the stimuli in the digitised resources. Krish claims that his learning through the traditional whiteboard determines his memorisation capacity. Learning through habits overshadows the impact of the

stimuli in the digitised resources on learning in the case of Krish. The contextual and socio-cultural factors influence Krish's learning, as he has been encultured to learn in certain specific ways. He has learnt the dynamics of his surrounding culture of learning and has acquired values attached with it. His behaviours and attitudes have created a pattern of cognitive growth towards the traditional whiteboard and it impacts on his learning through digitised resources. So, these findings contrast with the views of Zimiles (2000) who argued that the impact of digital technologies presents an urge to reconsider the patterns of cognitive growth of learners.

Stimuli in digitised learning resources indeed promote interest in learning leading to enjoyment in learning. However, learning through digitised resources is multifaceted. The findings divulge that learning through digitised resources reflect a set of circumstances where there is existence of both modern and postmodern constructs within a single environment, which is the classroom. Moreover, learning traits in a digitised classroom context are compared against learning styles where there was no technology.

7.4.3.2 Truth and identity not fixed

Krish's emotions revolve around sincerity and irony. On one hand, he is very happy to learn through the digitised resources and on the other hand, he prefers learning through the traditional whiteboard. His sincerity is depicted through emotions derived from the design features in the resources. He acknowledges that learning through the digital tools on the IWB makes learning effective. His irony is attached to the traditional method of teaching. Learning through digitised resources also concur with constructs of metamodernism where an oscillation exists between the postmodernism where a doubt for sense manifests and modernism where is a need for sense. The learner's habits determine his attitudes towards learning through digitised learning resources. Furthermore, findings agrees with postmodernists' views of truth and identity not being fixed. The emotions are true to the stimuli in the digitised resources but the identity is related to the values attached to learning through traditional methods of teaching.

7.4.3.3 Hypermodernity vs digimodernity

Krish's learning strategies are resonant with the enactivism theory of learning in the postmodern era. For Krish, meaningful learning occurs when he controls and maintains his position through his embodied actions. He shows that the multiple realities within the classroom contexts determine his preference for learning. Unlike Reeves (1998) who associated the learning strategies to the cognitive tools, Krish shows that his knowledge constructions are a result of his own framework through habits and experiences.

Contrasting with Raj's way of learning, Krish directs his learning through the teacher's use of the interactive whiteboard. This is an example of hypermodernity where the education system in Mauritius is not fully supporting the inclusion of technology in the primary classrooms. The argument is that despite the proliferation of technology in Mauritian education, the classroom set-up or teaching strategies used by the teacher do not fully promote the innovation in teaching and learning nexus. Hence, this dissonance has an impact on the way Krish negotiates his learning to enunciate meanings out of the concepts taught. In other words, Krish tries to adapt to new trends and technologies but is somewhat reluctant to let go his past practices. Krish can be seen as both nostalgic and futurist. However, Krish's findings do not support Kirby (2009) arguments on digimodernism. Despite being very active in his participation through digitised resources, Krish still has to come to terms with postmodernism since he is still a passive receiver of what the teacher teaches on the traditional whiteboard.

7.4.3.4 Modern enthusiasm and a postmodern irony

As for Krish, data about his learning reveal that he stands true to the teacher's pedagogical approaches in the class. Even though he enjoys learning through the digitised resources, he still prefers learning in the traditional way as it helps him to learn and remember better. For him, the pedagogical approaches used by the teacher have shaped his learning in a specific and determined way. Despite the fact that the digitised classroom offers opportunities for learners to acquire knowledge from learning activities, Krish prefer the modernist didactic teaching.

Krish's data do not concur with Prensky's (2001) claim that digital natives are 'wired' differently because of their exposure to digital technologies. Krish proves that he is indeed surrounded by digital tools as he relates to his home environment; however, his habits or culture towards past practices determines his learning preferences. This contributes to a new learning style, which links to habits and culture.

7.4.3.5 Human agency

Digital technologies in classrooms create a change in the context and learners shape technologies as much as technologies are shaping them. The digital technologies must be adapted to the human needs or human agency. For instance, Krish's data indicates that even though he enters the technological flows and acquires experiences from there, he does not deny the importance of his teacher and his habits or culture in learning. Despite being termed as 'digital natives' the human agency prevails and he explains his preference for the teacher using the traditional whiteboard to explain the concepts. He does not exclude human beings from humanness as pointed out by Samuels (2010). This analysis adheres to one key precept of metamodernism which in 'new materialism'. The focus is on connection between technological, biological, environmental and social processes of human activities (Fernandez, 2016).

In the case of Krish, the dynamic nature of the classroom including the IWB, peers and teachers are present but with no repositioning of mindsets. This finding deviates from Hekman's (2013) arguments that metamodernist can do what postmodernist failed to do. In fact, the learners move from postmodernism where technology is embedded and back modernism where knowledge imparted by the teacher is seen as the ultimate truth for learning to happen. He views the teacher's explanation as structured to facilitate learning where a unification of modernism and postmodernism also prevails. So, learning through digitised resources in the metamodern era is not fixed.

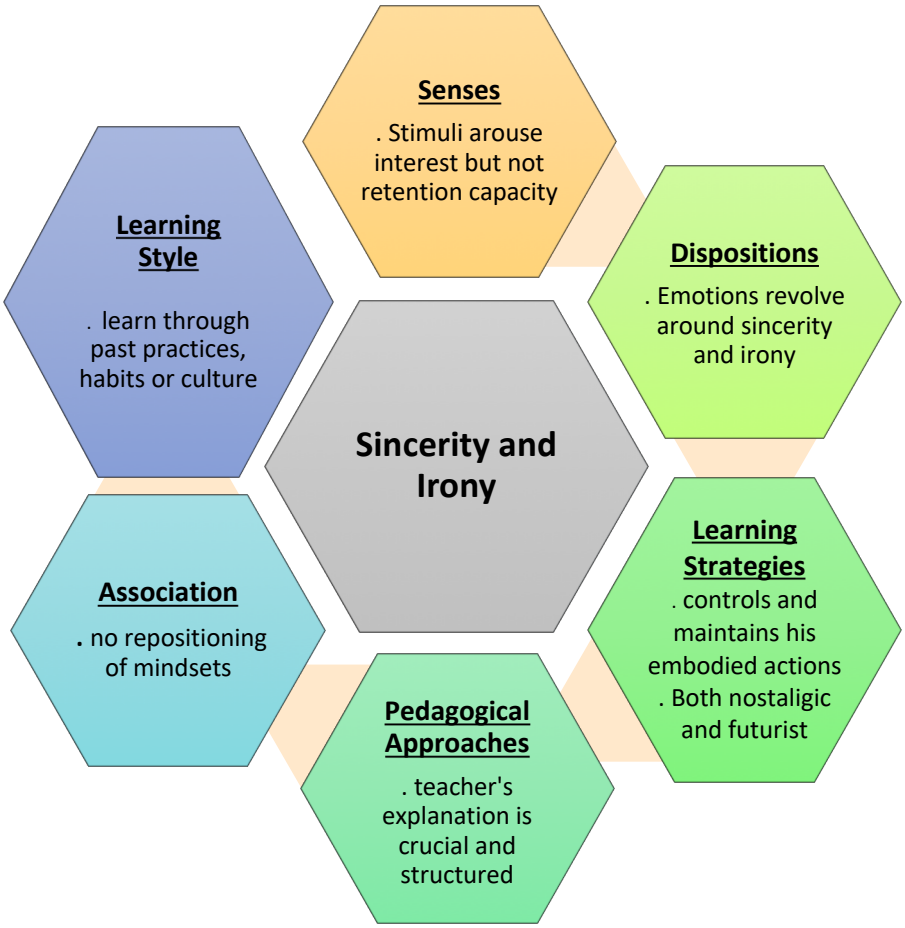


Figure 7.4: Interlocking factors informing Krish's learning through digitised learning resources

7.5 Section 4: Binding forces at the core of learning through digitised resources

The discussion of the untypical cases was done to show the disruptions in learning through digitised resources that emerged from the data. This in-depth analysis has also brought a higher level of abstraction concerning learning that came out of initial analysis stages. The learners' learning through digitised resources were mainly influenced by the learners' habits, culture, personality and associations made. Moreover, the lived experiences of the learners shaped the learning process and defined the learning outcomes. The forces from the micro and macro contexts of learners intersect to characterise learning through the digitised resources in an era where oscillation between modernism and

postmodernism exists. The learning revolves mainly around sincerity and irony, need for sense and link to hyperreality that proclaim themselves within the digitised classroom. However, despite these arrays of divergences in the way the learners learn through the digitised resources, all learners showed a common element in their representations. They all displayed that meaningful learning took place and that they were all able to narrate their learning logically, sequentially and in their own personalised ways. The learners' learning cannot be fragmented as insights obtained from a wealth of experiences grouped together to apprise the learner's learning through digitised learning resources.

Furthermore, this level of analysis has indicated the interlocking factors informing learning through digitised resources and emphasised the porous nature of the borders unravelling the learning process. This process of mapping out the factors (Figure 7.2, Figure 7.3, Figure 7.4) from the three participants has disclosed that learning in one context or from lived experiences cannot be ignored as the teacher mediates his teaching and the digitised resources. The blurred or permeable boundaries provide opportunities for a graceful connection between the forces as shown in Figure 7.5.

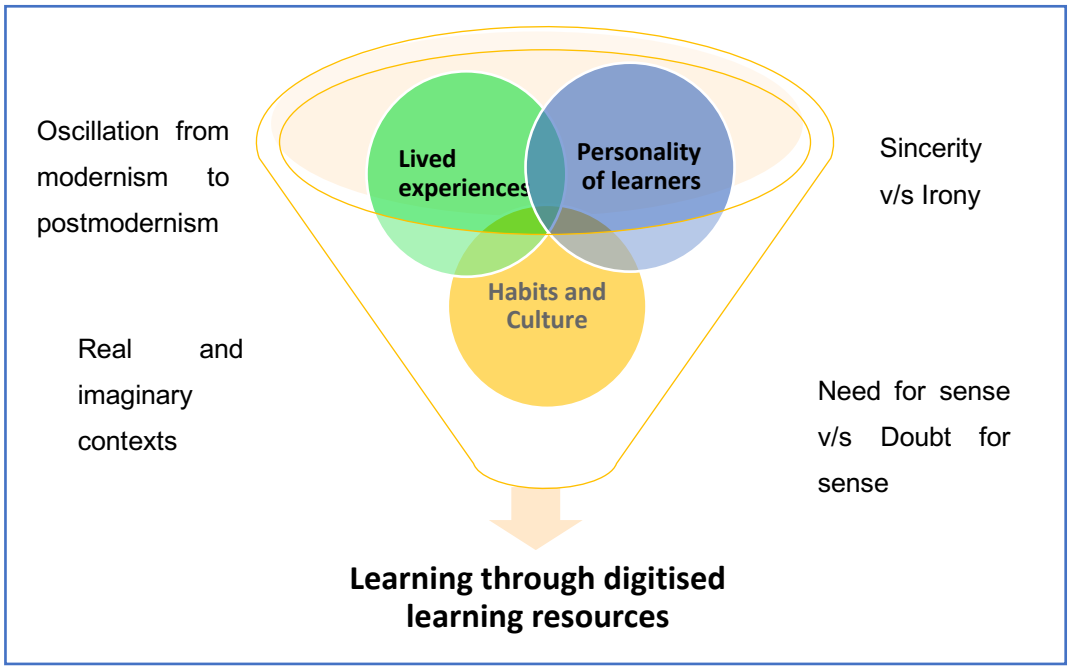


Figure 7.5: Learning through digitised resources at the core of enmeshed influences

The fact that learning develops at the centre of the entwined factors from diverse contexts explains how lived experiences promote specific behaviours and attitudes of learners. For instance, Raj displayed his ability to think beyond the lesson and create his own representations by linking with his past and learning experiences. He was able to think critically and narrate his learning logically and sequentially referring to his lived example. The experience was in fact a simulation beyond reality.

The discussion also outlined a prominent aspect of learning, which is the ability to associate learning to different things. The digitised resources included several features that helped to link with learners' environment, habits or culture. The leaners adopted a critical stance and dare to push boundaries beyond their thinking within the traditional digitised classroom context. This can be contrasted with the budding confinement of the learners towards their experiences.

A comparison of Raj and Karen illustrates this limitation. The pedagogical approaches that the teacher used were similar but the experiences of the learners differed. The learning that emerged from these two cases was from internal thinking processes. Karen was more exam-focused, whereas Raj was more focused on being reflective and creative. These learners' learning converged by developing the need for sense of the concepts but their goals or perceived objectives of the learning diverged. There was an oscillation from need for sense and doubt for sense. Nevertheless, the classroom context where teaching and learning occurred through digitised resources remained unchanged with the same old furniture and setting favouring transmission of knowledge by the teacher. The degree of creative thinking and development of higher cognitive levels was less apparent for Karen as she remained true to her habits, culture of learning or personality being introvert.

Therefore, discussing the antithetical cases have enabled the researcher to probe deeper into the influences that shape learners' learning through digitised resources in a metamodern era. The analysis of findings carried out so far, namely the analysis of the stories, cross-case comparisons and investigation of the boundaries provided responses to the first two research questions: What do

learners' learn through digitised learning resources in Mauritian primary schools? and How do learners' learn through digitised learning resources in Mauritian primary schools?

7.6 Section 5: Answering the research questions

7.6.1 Research question 1: What do learners learn through digitised learning resources in Mauritian primary schools?

The findings revealed a plethora of things that learners learnt through the digitised resources. These things ranged from formal to informal interactions within the usual classroom contexts. The formal and informal interactions occurred when the teacher was conducting the class in the usual traditional classroom context. The pedagogical approaches that the teacher used to conduct the classes through the digitised resources resulted in formal or informal interactions. The features in the digitised resources promoted different skills in the learners, namely, critical thinking, communication, collaboration and creativity which are indeed the 21st-century skills, as explained in Chapter 1. Being able to acquire these skills, the learners had to respect others and negotiate their positions towards the teacher and their peers. So, the learners were able to develop conceptual knowledge as well as 21st-century skills when learning through digitised resources.

Moreover, the findings revealed that learning through digitised resources promoted development of manipulative skills as well. Apart from construction of knowledge on the topic, the learners were also able to discover the tools on the IWB and use them effectively. They pointed out that they were happy to carry out the activities successfully on the IWB. Acquiring skills to use the digital tools effectively are lifelong learning skills. So, learning through digitised resources provided opportunities for leaners to be equipped with skills for the future.

The research has also revealed that learning through digitised learning resources also enhances the development of soft skills. Learners were able to adopt positive attitudes in the digitised classroom, as they had to wait for their turn to interact on the IWB. Furthermore, since the images in the digitised resources were used for brainstorming purposes, the learners had opportunities to engage

in discussions, thus enhancing their communication skills. Another soft skill that learners developed through the interactions with the digitised learning resources is time management. They had to create understanding about the use of the tools and act within the time allocated to them. Besides this, learners also improved their problem-solving skills, as they had to think critically to carry out the activities successfully using the stylus on the IWB. Lastly, learning through digitised resources contributes largely to the development of self-confidence. The learners expressed their increase in confidence when they were praised for their effort in using the stylus (special pen) to do the activity successfully on the IWB. In addition, they were able to create their self-identity and social identity within the classroom. Nevertheless, the interplay of the factors from diverse angles prompt the researcher to conclude that learning is subjective to the personality and habits of the learners and the mediation of the digitised learning resources within the teaching and learning nexus.

7.6.2 Research Question 2: How do learners learn through digitised learning resources in Mauritian primary schools?

Regarding research question 2, the study turned up with 'fuzziness in learning'. Learning through digitised resources is not neatly structured and layered as in Bloom's taxonomies' cognitive levels. There were learners who were developing an understanding of the concepts and creating their representations at the same time. As discussed in this chapter, learning cannot be generalised as there are various entangled influences that contribute to learning through digitised resources in diverse ways.

The first set of observations was that learners learnt through critical thinking when questions based on the visuals in the digitised resources were set to them. Critical thinking was developed only when the teacher provided opportunities for learners to discuss what they could see in the digitised resources. So, the pedagogical approaches that the teacher used were indeed determining elements for critical thinking to develop. However, no pertinent occurrence was found concerning the gender or level of learners developing critical thinking skills. It was in fact promoted in all the participants chosen in the research but at varied stages.

Findings also displayed learning through emotions and senses when learners were interacting with the digitised resources. These outcomes indicate the positive attitudes and bonding that emerged during the learners' interactions with the digitised resources. Thus, emotion acted as an important criterion enlightening the process of learning through digitised learning resources.

The researcher wishes to highlight the complexity of learning through digitised resources with the presence of the main forces and influences within or outside the classroom context. For instance, each learner takes a unique and personalised learning pathway, which lead to increased subjectivities in their learning. The subjectivities challenged the researcher's endeavours to provide clear-cut responses to research question 2. The researcher thus decided to focus on the main influences that affected the readiness of the learner's learning through digitised resources. They varied from lived experiences to habits or culture. Learners associated their learning of the concepts to their experiences to actually bring meaning and situate their learning within a context. Nevertheless, the contexts ranged from real to imaginary. The researcher observed that few learners linked their learning to their 'home' context experiences, which was in fact real. Others associated their learning of the concepts to their habits since their schooling years, which was still real. There was also one case where the association made while learning through digitised resources was beyond the real context and it was in fact a simulation. So, besides critical thinking, learners also learnt through association to make sense of the concepts displayed through the digitised resources.

Nevertheless, learning through teacher's explanations should not be undermined. While lived experiences were adjusted to match the learning through the digitised resources, in a few cases, the teacher was also still viewed as the 'all knower'. Full attention was paid to the teacher's explanation and learning occurred by passively absorbing the knowledge. So, in the same digitised classroom with a traditional set-up, there was a multiplicity of ways that learners adopted to learn. These ways ranged from passive absorption of knowledge to actively creating authentic representations of knowledge.

Enmeshed influences discussed in this chapter combined to promote the emergence of the distinct ways of learning through digitised learning resources.

7.7 Conclusion

This chapter focused on the factors influencing learning through digitised resources emerging from the analysis from Chapter 6. The factors were examined against the body of literature and theoretical frame used as a lens in the study. A justification of three outliers depicted from the findings was given. This rationalisation was then followed by an analysis on learning exclusively on three untypical cases. The binding forces at the core of learning through digitised resources were presented diagrammatically followed by an explanation. Diverse personalities, habits and experiences were the main forces that foregrounded learning in the three untypical cases. The learners adopted typical learning strategies to ensure effectiveness and meaningfulness in their learning. The notion of blurred boundaries across the different cognitive levels of learning that came up in the previous chapter was analysed more deeply in this chapter. Notably, the researcher opted to feature the complexity of learning. The discussion revolved around the interwoven factors across blurred boundaries in usual and unusual contexts. This emanates as a central outcome in this study. Furthermore, answers to the first and second research questions were also presented in this chapter. The analysis done so far serves as a stepping stone that will allow the researcher to theorise the findings and answer the third research question which is 'why do learners learn the way they do though the digitised learning resources in Mauritian primary schools?'

The next chapter will address the last research questions and an explanation on thesis building will be given. An explanation will provide on how this study contributes to the body of knowledge in the field of learning and how it pushes theoretical, conceptual and methodological boundaries. The researcher will also present her personal/professional reflections and scholarly contributions to the body of knowledge in the field. The chapter will end with the scholarly contributions of the study through a diagrammatic representation supported by

detailed description. The limitations of the study and possibilities of future avenues will summed up the next chapter.

Part 5: Learning through Digitised Learning Resources in the Metamodern era

Chapter 8: - Thesis building

8.1 Introduction

This chapter is the culmination of the study. At the inception, many questions had arisen and the researcher was captivated by the multiple ways learners engaged with the digitised resources. The learners' interactions during the use of the digitised learning resources were examined with a view to probing more deeply into learning through these resources within the Mauritian primary school context. The overall aim was to analyse the complexity of the process to understand how enmeshed influences impact upon learning through digitised resources. The findings provided deep insights for theorising learning through digitised resources in the metamodern era. They highlighted the multifaceted ties between the learners' lived experiences, habits, personality and their learning. In this chapter, the thesis building, the complexity of the learning through digitised learning resources is given attention and the last research question is answered.

This chapter draws upon the different levels of analysis to build the thesis. It is divided into three sections. In the first section, the different phases of learning through digitised resources in a metamodern era are explained. The second section introduces, the 'narrative model of learning.' It brings together the different elements showing the convoluted links across the phases of learning through digitised learning resources. A thorough explanation of the proposed model is provided. The last section is about the implications of the study namely theoretical, contextual, methodological and scholarly contributions. Then, the limitations of the study and the future research possibilities are detailed out. The chapter ends with a consideration of the personal and professional contributions of the study.

8.2 Phases of learning through digitised learning resources

From the findings of the study, it was deduced that learning is never static and it changes due to of diverse forces. The interplay between enmeshed influences can be described as being varied, complex, sincere and ironic. It is varied and complex in the sense that different learners have diverse ways of expressing themselves when they learn through digitised resources; sincere because sometimes in the same classroom context, there are learners who adhere to the knowledge imparted by the teacher; and ironic as few learners prefer to construct knowledge from their own experiences. Metamodernism was the lens used to analyse the findings in this study. The outcomes revealed many commonalities as well as certain disparities between learning in the modern and postmodern era as discussed in the previous chapter.

Furthermore, the learners' interactions triggered by the use of digitised resources showed blurred boundaries between different conceptions of learning discussed in Chapter 2. For instance, learning through digitised resources cannot be neatly structured into separate or distinct levels or taxonomies as each learner differs in terms of his/her personality, habits, culture and experiences. Furthermore, contexts affect learners' learning through technology. The contexts vary from home, school, or classroom whereby the learner's lived experiences evolve from his interactions at home whereas the habits and culture are nurtured in the home, school and classroom contexts. However, the personality of the learner is unique for each learner and this is a result of the learner's interactions in multiple contexts or oneself. Hence, learning through digitised resources is categorised into four phases, namely (1) internalise, (2) replicate, (3) customise, and (4) self-evaluate. The acronym IRCS is used to refer to the phases. Table 8.1 illustrates the elements emerging and evolving from the four phases (IRCS) of learning.

Table 8.1: The elements of the different phases of learning through digitised resources

Internalise	Replicate	Customise	Self-evaluate
• **Internal processing of information** • Processing information to make sense of the concepts • Learners see how the puzzle fits together and what the concepts are pointing to • Learners join segments of learning to make a whole mental representation of the concepts	• **Displaying learning** • Learners see themselves as being capable of projecting their learning from the digitised resources • Learners gather, organise and generate their understanding of the concepts	• **Personalised learning** • Learners create authentic pathways to learning • Learners are able to express their own experiences through learning • Customised learning helps to develop a sense of being of the learner	• **Learners review their learning strategies** • Self-monitoring progress • Learners are able to recognise their needs • Learners link their learning strategies to the teacher's pedagogical approaches

8.2.1 Internalise

Internalisation occurs when the learner experiences something in silence (Stephen, 2016). Very often, teachers can identify externalising behaviours of learners and refer to them as challenging behaviours. Internalising behaviours, on the other hand, are normally not easily visible and recognised (Stephen, 2016), but influence learners' learning. The word 'internalise' is used to describe the internal thinking processes that the learners are engaged in when they learn through the digitised resources. Different learners internalise information differently when they learn through digitised resources. For example, attentive and introvert learners tend to internalise the knowledge based on the visuals in the digitised resources and the teacher's explanations. This way of internalising knowledge was observed with Karen and Poovani who remained alert throughout

the class in order not to miss any important detail. The teacher's explanations and the information from the digitised resources were their main pathways to learning. They developed a pattern cognitive growth in the way they internalised the information and this was evidenced in their drawings as they replicated what they had seen from the resource and what they heard from the teacher's explanations. However, extrovert learners ask critical questions which lead to their knowledge construction. For instance, Raj was an extrovert learner who internalised the information through critical thinking and produced creative representations of his learning. Raj was able to engage in higher-order thinking relating to his lived experiences. This difference in mental construction of knowledge culminates into the phase 'internalise'.

8.2.2 Replicate

'Replicate' refers to reproducing the information according to one's own interpretation. The study revealed that enmeshed influences affect the process of knowledge replication. For instance, the learning strategies that the learner adopts to learn through digitised learning resources influence the manner the learner replicates his knowledge. A learner who chooses to learn passively replicates exactly what he or she sees from the digitised resources and the teacher's explanation while a learner who learns actively develops his learning through association. Karen was a passive learner and duplicated what she saw from the resources to display her learning of the concepts. Krish also learnt through association that he made between the visuals in the resource and his experiences but he replicated the sound that he heard from the digitised resource while narrating his learning experience. Replication of learners' learning was also depicted in their drawings. Drawings allowed the learners to display their learning of the concepts in their own personalised ways where habits, culture, personality and lived experiences play a major role. For instance, Raj replicated his learning through a series of scenes whereby his learning of the concepts was integrated. This explains that the phase 'replicate' is personalised and related to the phase 'internalise.'

8.2.3 Customise

The word ‘customise’ has been chosen to explain how learners tailor their learning according to their preferences. The modification of learning is based on the learner’s personality, habits, culture or lived experiences. Nevertheless, the prerequisites for customisation cannot be stated as each learner uses specific pathways to customise his or her learning. Customising learning brings out the element of authenticity in learners’ learning through digitised resources. The learner reflects critically on the concepts learnt to customise his or her learning. Moreover, customising learning encourages the learner to develop creativity, which is one of the key skills of the 21st century. For instance Raj and Pranish customised their learning in their own authentic ways. Raj connected his lived experiences with the concepts learnt and produced a simulation of his learning. He was able to customise his learning within a context familiar to him. Pranish also situated his learning in context by drawing an animal breathing ‘Air’ from the atmosphere. Both Raj’s and Pranish’s drawings were not a duplication of what was displayed on the digitised resource. Out of the seven participants, five coloured their drawings according to their preferences and creative skills and the visuals in the digitised resources, thus customising their learning. Therefore, learning through digitised resources equips learners with the creative skills deemed essential to living in this new era. The process ‘customise’ culminates in the learners appropriating and narrating their learning in their own specific ways. The narration was presented through either visual representations or verbal accounts by the learners. Some learners are able to bring in more creativity when they are customising their learning whereas others cannot do so proficiently. The process of ‘customising’ results into creative and authentic narration of learning concepts.

8.2.4 Self-evaluate

Evaluation plays a key role in learning as it helps to give value to learning. Learning through digitised resources encourages self-evaluation. Learners are able to make judgements on their own learning. The introspection that the learner makes on his or her own learning enables reflection on his or her learning of the concepts. For instance, learner Raj self-evaluated his learning of the concept

‘object falling down quickly’ by showing the car key of ‘batmobile’ falling down quickly. He self-evaluated his learning by situating the concept within an appropriate context. Ludy also self-evaluated her learning by applying the concepts learnt within a context familiar to her. She indicated how heat energy helps to dry clothes, which was not part of the visuals in the digitised resources. The teacher’s pedagogical approaches, the stimuli in the digitised resources or the learning strategies used by the learner also help in self-evaluation. Since permanence of information is possible through the use of the digitised resources on the IWB, learners are able to self-evaluate their learning by referring to the information in the resources on several occasions during their learning. In other words, learners are able to conduct a self-evaluation of their learning during the lesson. However, self-evaluation is not necessarily the last phase in the learners’ learning through digitised resources. The learners can still go through any other phase in learning to re-process the information.

The four phases explain the different processes of learning through digitised resources. However, these phases are not arranged in a cascading style whereby one phase follows another phase in a structured and hierarchical manner. Since learning through digitised learning resources is fuzzy (discussed in Chapters 6 and 7), the phases cannot be organised in a rigid way. When the four phases are linked together, they culminate in a ‘narration’ of learning. Irrespective of the personality, culture, habits or lived experiences, all the learners were able to narrate their learning through digitised resources in their preferred ways. The researcher decided to represent the four phases of learning through digitised resources through a model, called ‘narrative model of learning’. The next section will explain the ‘narrative model of learning’, and the interrelationships across the four phases.

8.3 The ‘narrative model of learning’

The ‘narrative model of learning’ has been developed to explain the dynamic interactions across the four phases of learning through digitised resources. Naming the model as the ‘narrative model of learning’ is deliberate. The intention is to show that learning through digitised resources culminates in narrating

learning in authentic ways. Among other skills, the learner develops the ability to narrate his learning in a logical and sequential manner. Figure 8.1 is a graphical representation of the 'narrative model of learning'. The blue arrows indicate the dynamic interactions across the different phases. The green circle represents the context, which influences learning through digitised resources.

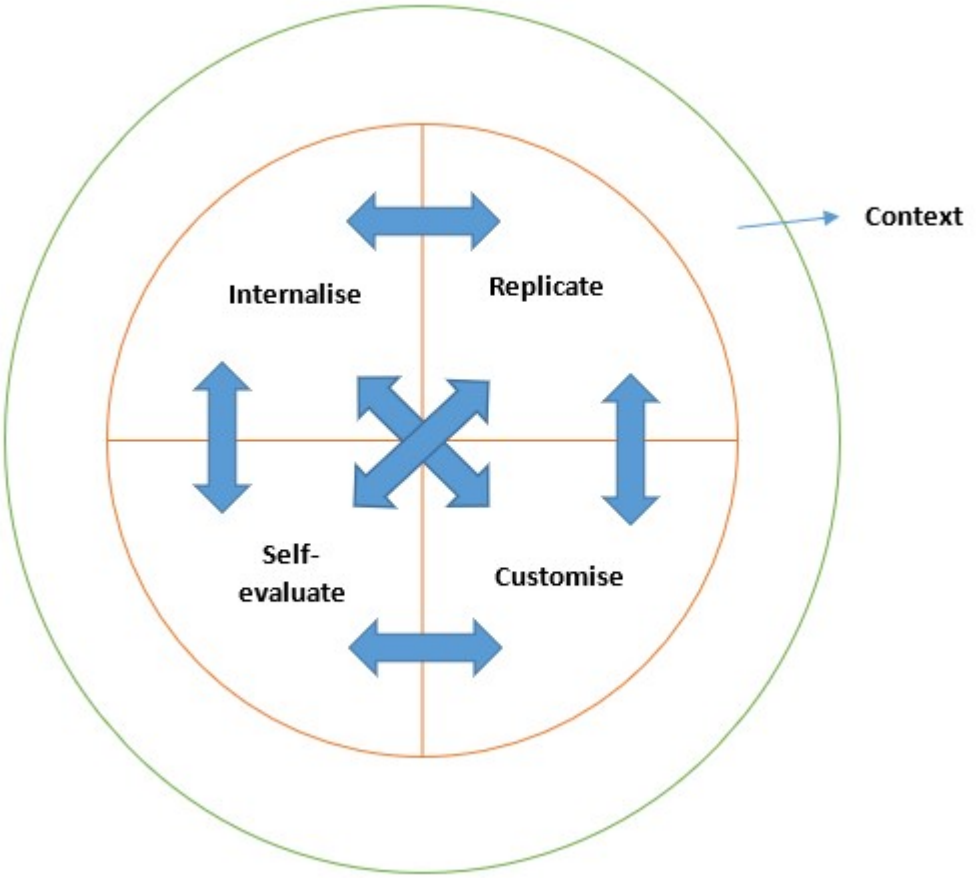


Figure 8.1: 'Narrative model of learning'

As indicated in Figure 8.1, within the 'narrative model of learning' the learner can move in any direction when he learns through the digitised resources. There is no predetermined starting phase, pattern or hierarchy in the learning. This is due to learners' attitude being unpredictable when they learn through the digitised resources. The seamless boundaries between the phases also explain the agility with which the learners move across the different phases during their learning in a dynamic manner. Despite the sinuous movements, learning through digitised resources is a logical process. The interactions the learners engage in between

the phases when they learn through the digital resources makes the learning logical and sequential.

Nevertheless, these phases are not to be used as prescriptive as in the revised Bloom's taxonomies (Shabatu, 2018). Learning through digitised resources is dynamic, and not cascading. Therefore, the pathway that each learner takes to learn the concepts through digitised learning resources differs according to personality, lived experiences and habits or culture, which forms part the context. This can be seen in Figure 8.2, which illustrate two learners' ways of learning through digitised resources. Learners A and B learning pathways are plotted on the 'narrative models of learning' in Figure 8.2.

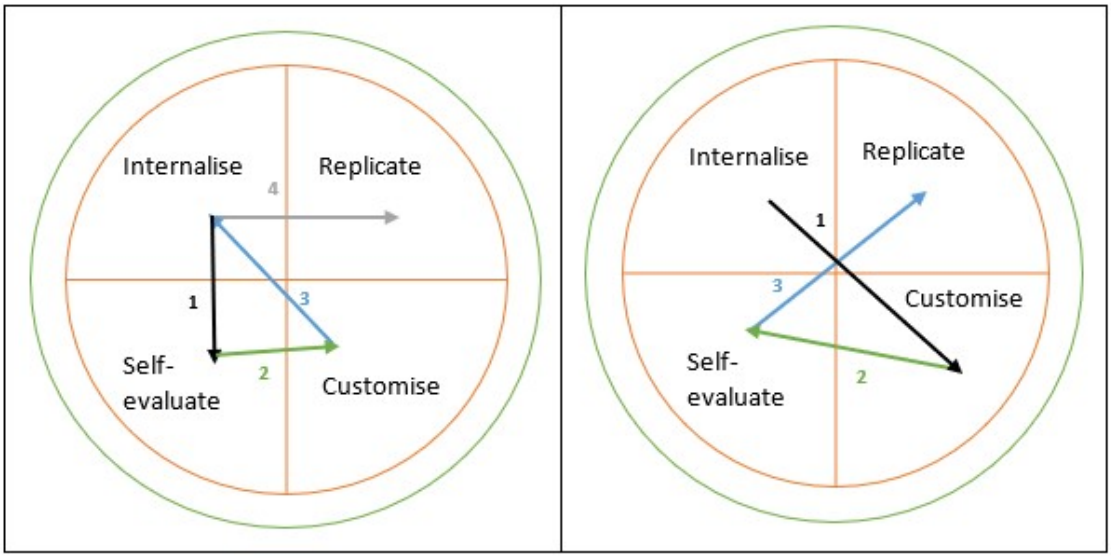


Figure 8.2: Narrative models of learning (A & B)

Learner A

Learner A is an introvert and his learning pathway occurs in four moves. The coloured arrows indicate the learner's routes across the phases to learn the concepts through the digitised resources. Learner A's learning is logical and sequential.

The learner internalises the information received from the digitised resources and the teacher's explanation. He then self-evaluates the information. Next, he customises the concepts learnt in his own way. However, his customisation of

the knowledge is limited, as he does not integrate his lived experiences extensively in his narration of learning. The researcher has tried to represent the limited customisation of learner A in the quadrant 'customise' in Figure 8.2, by placing the green and blue arrows near the centre of the model. The researcher wants to show that in the case of learner A, his customisation does not occupy the whole quadrant but only very little. It should be noted that this is just a representation of the extent to which the learner can 'customise' but the degree is not measured to scale as this was not the focus of the study. Depending on the learner's characteristics, this application can be applied to the other quadrants as well. Therefore, the 'narrative model of learning' is dynamic across as well as within the phases.

Learner A then goes back to the phase 'internalise' and finally replicates what he sees in the digitised resources in his narration. Learning through digitised resources provides the opportunity for introvert learners to revert to the 'internalise' phase before actually replicating it. Therefore, introverts focus more on internalising the information before replicating it (see Chapter 7, p. 225 for an example).

Learner B

Learner B is a creative amateur (see Chapter 7, p. 239 for an example). His learning pathway occurs in three moves. When he learns through digitised resources, he connects what he sees from the digitised resources to his lived experiences, thus moving from the phase 'internalise' to the phase 'customise'. He then self-evaluates his learning and lastly replicates his learning through narration. Here, the lived experiences of the learner affect his learning through digitised resources. There is an emphasis on the phase 'customise', which makes his learning creative and authentic. The researcher tried to show that learner B spends more time customising his learning by placing the black and green arrows further within the quadrant. Again, this is only a representation of learning being dynamic and personalised; no data has been plotted to scale.

Thus, the 'narrative model of learning' depicts multiple learning pathways through digitised resources, which are, dynamic. For example, when the learner is internalising the knowledge, the process of internalisation does not remain static but changes in the course of the lesson.

To a certain extent, this 'narrative model of learning' fills the gaps identified in the literature in Chapter 2. Firstly, this model of learning is more relevant to represent learners' learning in the 21st century where more classrooms embrace the use of digitised resources. The phases are an apt representation of learning in the metamodern era. Secondly, this model is very useful to designers of digitised resources. The 'narrative model of learning' provides deep insights into the dynamic processes involved in learning through digitised resources and thus informs the instructional designers in the design of digitised learning resources. Instructional designers may include features in digitised learning resources that help in promoting the different phases of the 'narrative model of learning.' Thirdly, this 'narrative model of learning' has been developed from empirical evidence, which projects learning through technology in actual classroom situations.

8.3.1 Research question 3: Why do learners learn the way they do when using the DLRs in Mauritian primary schools?

The inbuilt dynamism of the 'narrative model of learning' which revolves around the different phases highlights learning through digitised resources as an active and ongoing process. The learning strategies and pathways evolve because of the continual learning process of the learners when they learn through digitised resources. The learning strategies depend on the meaning that they derive from the concepts learnt. These meanings are constructed with respect to their lived experiences, culture, habits and personality. As part of the fuzzy learning process, learners constantly self-evaluate their learning as evidenced in their learning. This results in the adoption of learning strategies, which are reflective, evaluative and dynamic. However, the phases of learning through digitised resources intersect in different ways for different types of learners, thereby offsetting attempts to streamline the learning process into something uniform and structured.

Learners' learning through digitised resources is diverse and personalised. While all learners orient their learning through emotions (see Chapter 7, p. 241 for example), they nevertheless retain their personality that shapes their learning pathways. Learning through digitised resources promotes personalisation in the ways learners narrate their learning. So, anyone can learn through the digitised learning resources as it encompasses learners with different personalities, habits, culture and lived experiences. Moreover, the support is not solely from the digitised resources but may be in the form of the teacher's pedagogical approaches or the learning strategies that the learners adopt. The learners are not followers when they learn through digitised resources; they are in fact creators of their own authentic representations of learning. They may not be experts in using technology but, with the support of the teachers, they thrive in learning the concepts through the digitised resources. This explains why irrespective of the kinds of interrelationships across the phases in the 'narrative model of learning', the learners are able to make sense of the concepts in a coherent, chronological and logical manner. Though learners' pathways to learning differ, they are all able to narrate their learning effectively. Therefore, 'all learning is narrative'.

The 'narrative model of learning', thus aptly represents the dynamic process through which learners construct and re-construct knowledge and understanding of concepts – the learning of which is subject to the type of learner they are. These learnings are not static and are likely to change over time in relation to internal and external factors. Hence, the learners learn the way they do when using digitised learning resources because the learning is dynamic, logical and personalised.

8.4 Implications

This study contributes to the body of knowledge in varied ways. The new knowledge emerging from the 'narrative model of learning' displays new learning routes concerning learning through digitised resources. The section below explains the different reflections and contributions that this study brings to the

body of knowledge in terms of learning through digitised resources in the metamodern era.

8.4.1 Theoretical/conceptual contributions

From a theoretical perspective, the 'narrative model of learning' proposes a new and different lens to view the multifaceted nature of learners' learning. By representing learners' learning in such way, it is possible to crystallise the complexities allied with learning through digitised resources. The model is analogous to probing into neuroscience and the learning brain, as the four phases indicate how the learners process information in their brain when they actually learn through digitised resources. The processes involved in the different phases, internalise, replicate, customise and self-evaluate, are all connected to the brain. The main contribution of the study is that learning through digitised resources triggers the brain to process information in an unstructured manner.

Learning through digitised resources, as presented through the 'narrative model of learning', disrupts the influential myth that learners learn effectively when the teaching is matched with their preferred learning style (Goldhill, 2016). Learning through digitised resources in the metamodern era is so complex that a distinct preferred learning style cannot be attributed to a learner. The learning preferences of the learner change over the lesson due to multiple influences, namely emotions, learning strategies, pedagogical approaches, stimuli in the digitised resources and the pathway to learning. This study also reveals that the teacher is not the only expert as expertise is distributed throughout the classroom. The learners take ownership of their learning and become their own creators of knowledge when they learn through digitised resources. Therefore, instructional designers of digitised resources need not be adamant about matching the design features in the digitised resources with learners' varied learning styles, as learning is unplanned. Nevertheless, designers should create opportunities for learners to match the 21st-century skills (explained in Chapter 1) and become creative amateurs, as these are vital for the future job market.

On the practical side, this study assists various stakeholders in education to comprehend the multiple ways through which learners learn and the numerous

factors that bring about dynamism in their learning. Such insights prompt policy makers, teacher educators, and educators to consider the factors that lead to promote learning through digitised resources in a metamodern era. This culminates in informing curriculum development at macro, meso and micro levels. The curriculum should be adjusted to the learners' ways of learning within the classroom reality. Understanding how learners are thus crucial to policy decisions as they bring in valuable insights into curriculum development, assessment and evaluation. Moreover, the study reveals learning and metamodern theories grounded in practice. Hence, this study helps bridge the gap of what is propounded in the NCF (2016) and the actual learning through technology.

8.4.2 Methodological contributions

The major methodological contribution that this study brings is the development of creative short stories to present learners' learning. An attempt to understand learning through digitised resources through short stories entailed in-depth study of how the learners learn and why they learn in such ways. Unlike representing the learning through case studies, short stories offer advanced possibilities of displaying authentic and textured representations of actual learning situations. For instance, the emotions of the learners during their learning are better portrayed through the scenes in the stories. Furthermore, short stories allow for more clarity since the learning experiences can be depicted in a vivid manner. The reader gains an understanding of the phenomenon while enjoying reading, and being hooked by the essence of the story.

Short stories also allow the researcher to dig into the learners' understanding of the concepts, their thinking processes and their emotions – all those substantial features that are difficult to capture in case studies. Moreover, creative short stories provide a situational representation of the context, whereby factors within that context that combine to bring value to the phenomenon are considered. Combining all the data and twisting them into creative scenes to make up the story brings a methodological contribution as to how data of different cases can be represented in the form of creative short stories.

Furthermore, using children's written short stories to present findings is not very common in academic research but has many plusses. Short stories allow the researcher to foreground the voice of the child (the participant) more acutely than in case studies. It gives an original touch to the simple and non-technical language that the child actually engages in during the research instead of the researcher reporting what happened. Moreover, the researcher can attempt to write in different styles or genres to foreground the phenomenon convincingly while weaving the story. Hence, when the child's voice is heard through the stories, the authenticity and credibility of the research are enhanced. Therefore, children's creative short stories in academic research about children contributes to a new approach to display the phenomenon under study.

8.4.3 Contextual contributions

The study was carried out in schools where learners came from diverse socio-economic backgrounds. Nevertheless, learning through digitised resources promotes different levels of cognitions among all learners, irrespective of their socio-economic background. However, the learners' experiences, habits, culture and personality are dictated by their contexts. These contexts may be their home, classroom or schools. In addition, the teacher also influences learning through technology. Therefore, learning through technology is a narrative where contextual factors largely influence the process of learning.

Moreover, these conceptions of learning in the metamodern era also reconcile the paradoxes of the modern and postmodern eras regarding learning. The vivacity of the interactions across the phases when learners learn through technology explains that conceptions of learning in modern and postmodern era can also coincide, leading to a dynamic type of learning. Both oscillation between modernism and postmodernism and merging of modernism and postmodernism occur when learners learn through digitised resources in the metamodern era. However, contextual factors affect the oscillations in the nature of the learning. Learning through digitised resources is fuzzy and this feature does not actually match with the traditional classroom set-up, which favours teacher-centredness, being rigid and structured. Since this study informs that learning through technology is personalised, socialised and creative, the digital classroom set-up

should be made more flexible to promote interactions with peers, the digitised resource and the teacher. The new flexible classroom set-up will align with the goals of the NCF (2016) of promoting 'effective use of new technologies as tools for teaching and learning' and 'equipping learners with 21st century competencies' (p. 3).

8.4.4 Scholarly contributions

The main scholarly contributions of this study is that 'all learning is narrative' or 'learning is a narrative'. From the 'narrative model of learning', learners' learning through digitised resources is emotional, logical and dynamic. Learners are able to narrate their learning in a personalised way. Moreover, oscillations occur in the learners' learning as their learning pathways change with the influences present in the digitised classrooms.

Learning can at times be irrational as there is always a certain causality present when learners learn through digitised resources. For example, the learner can be a creative amateur but if the topic taught on a specific day does not interest her; her learning pathway might deviate from that of a creative amateur. Therefore, learning through digitised resources is complex and cannot be measured in terms of preferred learning styles. Diverse changes in the context or situations can alter the ways the learners learn. Hence, learning is not fixed and does not have a structure. It changes with the interactions of the learners within the digitised classroom.

Another contribution to knowledge is that learning through digitised resources is related to the promotion of the learner's social identity. The learner is able to develop a sense of belonging among peers when actually interacting with the digitised resources. However, the promotion of social identity does not occur in isolation. It is in fact associated with the teacher's pedagogical approaches and the emergence of emotions within the digitised classroom. Hence, social identity is constructed or reconstructed when active learning happens through digitised resources.

Unlike the theories of multiple intelligences where stimuli in a classroom determine the preferred learning styles of learners, learning through digitised resources brings another dimension to learning. The stimuli affect learning but need not always be present for learning to take place. The learners may make abstraction of the stimuli and still learn meaningfully through the digitised resources. Learning through digitised resources allows the learner to become a narrator who can be multi-dimensional, unifying and social.

Another scholarly contribution is that learning through digitised resources makes learning happen in virtual reality. The learner is able to bring concepts learnt and lived experiences into virtual realities. The learner simulates what he or she learnt into creative narrations. Virtual realities and lived experiences are two sides of the same coin when a learner learns through digitised resources. The learner is able to integrate lived experiences with the concepts learnt and present a simulation of this learning in virtual reality. Therefore, the conditions that enable learning through digitised resources conspire to bring the learner's learning to a higher level of cognition, which is virtual reality.

8.5 Limitations

This study generates an understanding of Grade 4 learners' learning through digitised resources. While it sheds light on new insights about learning in a digitised classroom, it can also be argued that these outcomes are relevant to contexts that are similar to those in Mauritian primary schools and, as such, cannot be generalised to different school contexts.

Moreover, as revealed from the findings, learning is an individualised process and the learning of the seven selected participants in Grade 4 primary classrooms cannot be in a way representative of all the learners of eight to nine years old. Had there been more participants, the findings could have been different as learners' experiences, habits, culture and personalities might differ.

The time spent or timing in the field are other weakness. While data collection was done over a period of six months, spending more time in the field could have brought to the fore more insights about the phenomenon. In addition, the

participants' learning were observed at a particular period during the school terms, when the teachers were introducing the concepts. The findings could have been different if the lessons taught had not focused on an introduction to the topic but had been a continuation of a previous lesson.

Furthermore, the case study methodology, despite being appropriate for this study, also has certain restrictions. In case study methodologies, the cases are observed within specific time and space and it is not always possible to generalise the findings. Inferences made from particular instances may not always lead to general statements. In other words, using case study as technique for data collection may not always lead to conclusions as causality are present. Each case may be specific and not be representative of the larger population.

Finally, the researcher must disclose that having been a primary school teacher, she is somewhat bound by her own teaching experiences. Her personal teaching experiences and current position as a teacher educator may have involuntarily influenced interpretation of the data.

8.6 Possibilities for further studies

In the researcher's opinion, the study has brought to light prospects for further research in the field of learning. The future possibilities stemming from this study to be considered are varied. Firstly, the 'narrative model of learning' displays powerful links across the different phases of learning. These multi-directional interactions across the phases reveal varied types of learners and learning styles when learning occurs through digitised resources. A closer look at the dynamic interactions when learners learn through digitised resources would eventually shed light on different categories or types of learners.

Secondly, further research would investigate the extent to which the learners learn in each phase during the use digitised resources. This would eventually lead to deeper levels of analysis of the learning process in each phase.

Thirdly, future research would investigate how far teachers, teacher educators or policy makers reconcile their curriculum development and assessment strategies with learners' dynamic learning through digitised resources. A thorough

examination could be on how teachers or teacher educators could better develop lesson plans to match the dynamic nature of learning. Future research could also explore how to assess learners' learning through their narratives when they learn through the digitised resources. These future studies would further inform policy decisions about teaching and learning in a primary school context. Hence, the agendas of policy makers and policy implementers could be aligned; a point of convergence could probably be found between curriculum that is declared, embraced and enacted.

Fourthly, creative short stories have been used to capture and retain the richness of learning in context. Within these short stories, other avenues of research can emanate. For instance, creative stories can be revealing to uncover patterns of learning or even possibly learning difficulties among learners.

The avenues for further research are limitless but the ones mentioned above arise directly from the study. Indeed, the research investigation may be reproduced in another context or with other participants. While the 'narrative model of learning' has emanated from the Mauritian context, the model is not exclusive only to the local context. It would be noteworthy to apply this model to other regional contexts, for instance, Africa, to get a better grip on how the peculiarities of contexts may affect learners' learning. A comparative study of learning in diverse contexts would definitely provide deeper insights about learning through digitised resources.

8.7 Personal and professional reflections

The researcher feels that doing this study at PhD level has helped her to grow personally and professionally in different ways. Personally, creating short stories was a new experience. The researcher was able to deepen her knowledge about writing short stories to foreground the data obtained from different sources while at the same time sustaining the reader's attention. The researcher also gained the skills to write short stories to revive the findings in a creative and authentic manner while remaining true to the data. In addition, being an adult writing short stories for children was not an easy task. The researcher had to remove the researcher 'hat' and was considered as being in the shoes of the child to produce

simple childlike language to situate the child learning within the stories. The researcher can still hear her supervisors telling her: ‘You have to write in the child’s language to reveal the child’s learning in the stories!’ It was a long journey but, after several versions, she is indeed happy to have become a ‘creative amateur’ in the domain of writing short stories.

Another personal achievement in her journey of writing this PhD is being able to analyse learning from the lens of metamodernism. Not being a researcher from the field of sociology, she was not fully aware of the evolution of learning from different eras. The researcher read extensively around learning and now understand better how learning changes with the sociological context in different era.

Moreover, writing this thesis gave her the opportunity to improve her academic writing skills. The researcher was able to cultivate the skills of writing for an audience and writing at a higher level. It also helped to enhance her organisation and planning skills.

Professionally, the researcher gained a lot from writing this thesis. The researcher now has a broader understanding of learners’ learning in the 21st century and am therefore in a better position to assess the design of digitised resources for primary school learners who are actually 21st-century learners. She is better prepared to advise different stakeholders on how to better develop digitised curriculum and teacher education with respect to 21st-century pedagogies and strategies.

This study also provides meta approaches to learning in the metamodern era. The researcher now has an awareness and understanding of the phenomenon of learning with empirical evidence as opposed to theories of learning. These meta approaches reveal more about learning approaches that reflect the oscillations from modernism to postmodernism declared in metamodernism.

Lastly, the researcher feels that she has grown as an academic through her journey as a PhD candidate, throughout the realisation of the thesis. The

researcher has now a deeper understanding of the field that she is actually working in. This thesis has helped her to enhance her practice.

8.8 Conclusion

This study is an opening to teaching and learning through technology. It is clear that 'all learning is narrative' is a term that contains many ingredients. Learning being narrative is woven together from a number of enmeshed influences, some habits, some culture, some personality and some lived experiences. Learning is complex and not fixed. Fluidity of learning through digitised resources should be acknowledged and learners' achievements in all domains of learning should be valued. The 'narrative model of learning' has pushed boundaries and provided a suitable educational fit, which responds to the challenges of the 21st century learners.

Indeed, while doing this thesis, the researcher realised that learners cannot be separated from their contexts and emotions. Since learning is a very complex phenomenon, the choice of story was to position learning within an authentic situation. Stories are usually used to narrate complex situations such as death, separation, loss, in order to situate them within a context. The meanings are usually entangled within the stories. Hence, the use of creative short stories to explain complex phenomena should be encouraged in educational research.

A prevailing educational system is engrained in fixed epistemologies whereby input is measured against output. A shift in ideologies and methodologies is required to allow learners to challenge their own learning and thus be creators or co-creators of knowledge.

The world has evolved. In today's educational arena, learning through technology has become part of our classroom practices. Thus, the researcher would like to advance that, for curriculum development and educational policies to align with 21st-century skills, policy makers should delve into teaching and learning through technology. We must adapt to instances that jar, and not from instances that gel to sustain a healthy future education.

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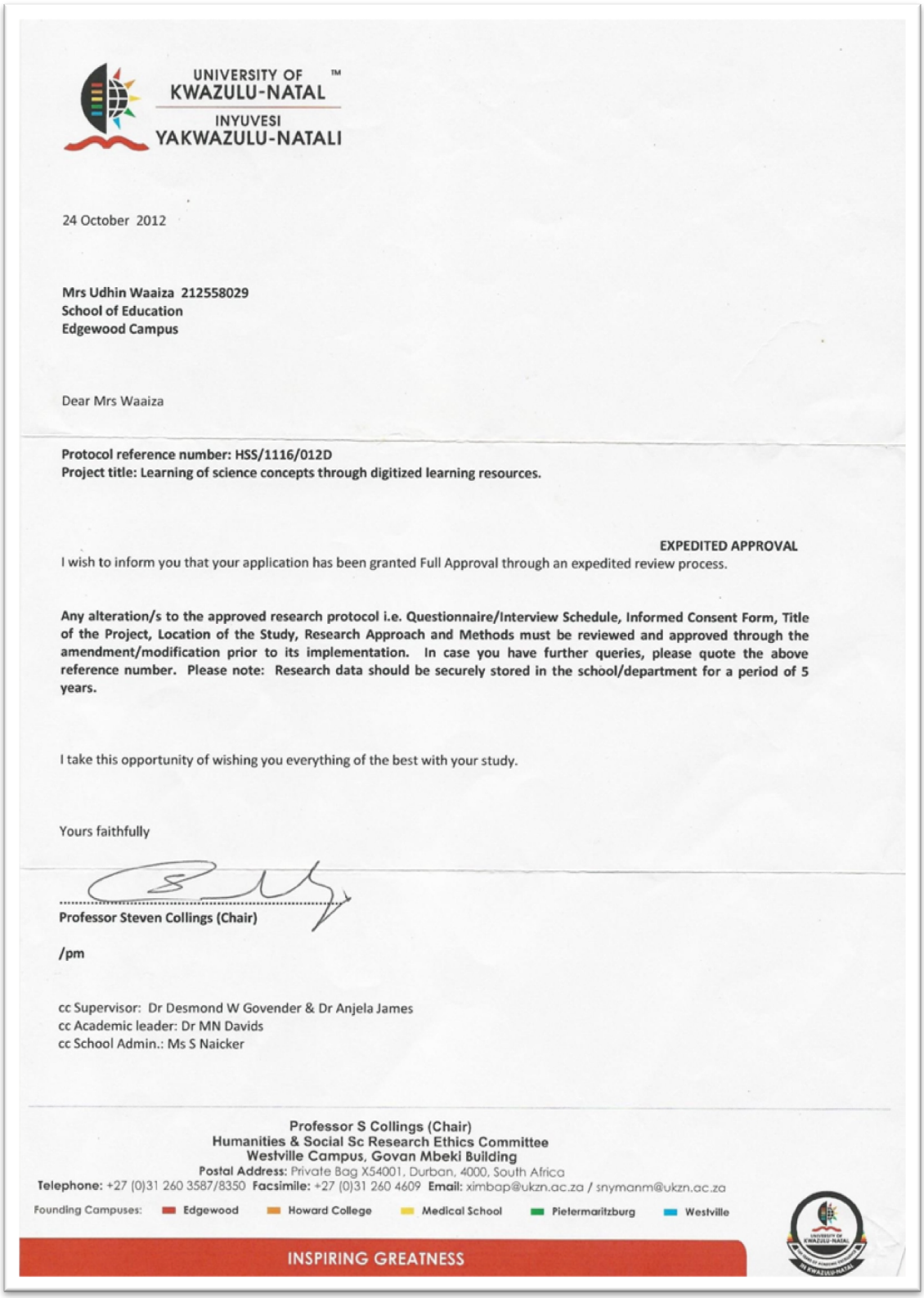
Appendices

Appendix 1- Ethical Clearance to conduct research



UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

24 October 2012

Mrs Udhin Waaiza 212558029
School of Education
Edgewood Campus

Dear Mrs Waaiza

Protocol reference number: HSS/1116/012D
Project title: Learning of science concepts through digitized learning resources.

EXPEDITED APPROVAL

I wish to inform you that your application has been granted Full Approval through an expedited review process.

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment/modification prior to its implementation. In case you have further queries, please quote the above reference number. Please note: Research data should be securely stored in the school/department for a period of 5 years.

I take this opportunity of wishing you everything of the best with your study.

Yours faithfully

Professor Steven Collings (Chair)

/pm

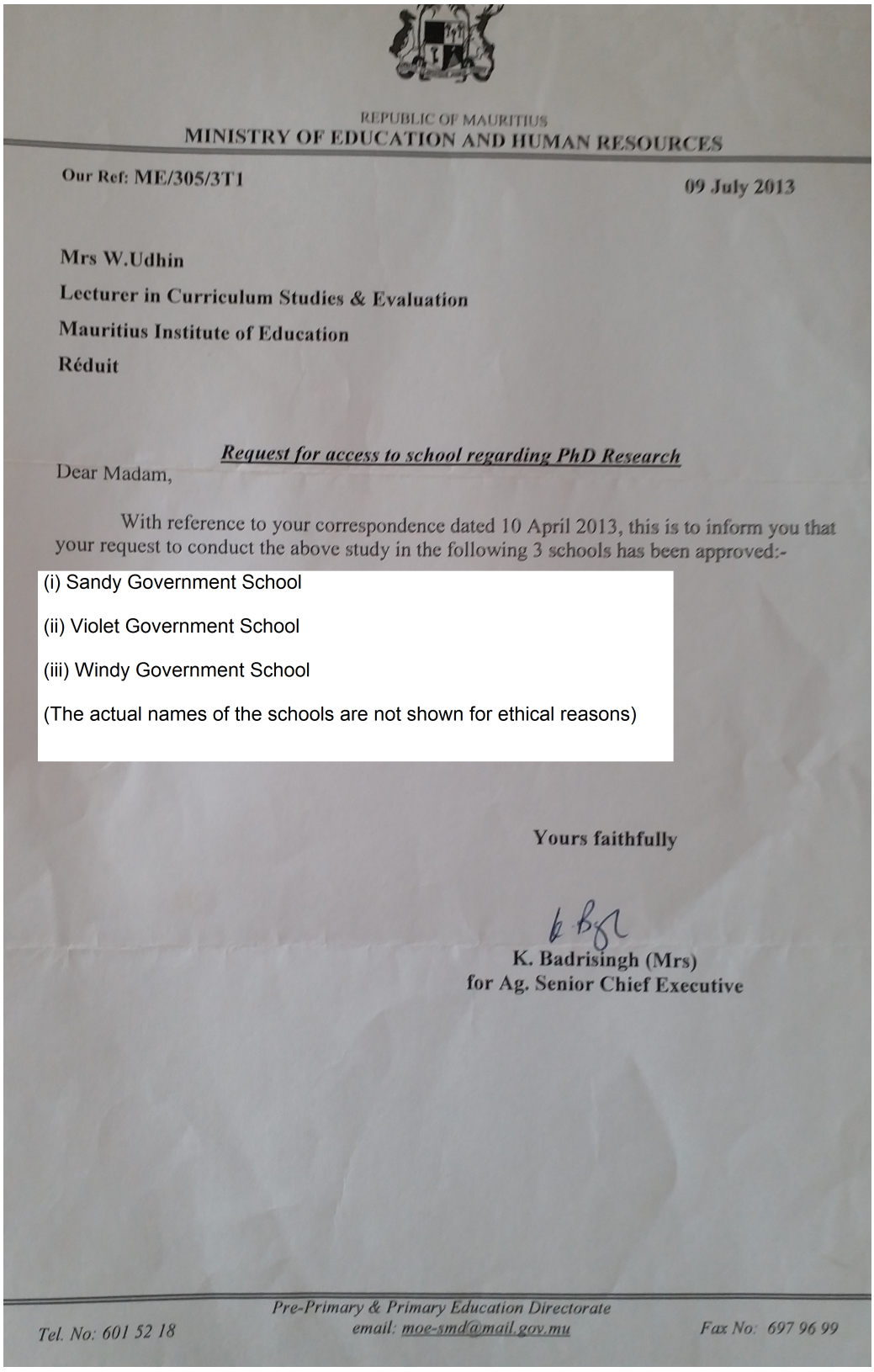
cc Supervisor: Dr Desmond W Govender & Dr Anjela James
cc Academic leader: Dr MN Davids
cc School Admin.: Ms S Naicker

Professor S Collings (Chair)
Humanities & Social Sc Research Ethics Committee
Westville Campus, Govan Mbeki Building
Postal Address: Private Bag X54001, Durban, 4000, South Africa
Telephone: +27 (0)31 260 3587/8350 **Facsimile:** +27 (0)31 260 4609 **Email:** ximbap@ukzn.ac.za / snymanm@ukzn.ac.za

Founding Campuses: Edgewood Howard College Medical School Pietermaritzburg Westville

INSPIRING GREATNESS

Appendix 2- Access to school to conduct research



REPUBLIC OF MAURITIUS
MINISTRY OF EDUCATION AND HUMAN RESOURCES

Our Ref: ME/305/3T1

09 July 2013

Mrs W.Udhin
Lecturer in Curriculum Studies & Evaluation
Mauritius Institute of Education
Réduit

Request for access to school regarding PhD Research

Dear Madam,

With reference to your correspondence dated 10 April 2013, this is to inform you that your request to conduct the above study in the following 3 schools has been approved:-

(i) Sandy Government School

(ii) Violet Government School

(iii) Windy Government School

(The actual names of the schools are not shown for ethical reasons)

Yours faithfully

K. Badrisingh (Mrs)
for Ag. Senior Chief Executive

Pre-Primary & Primary Education Directorate
Tel. No: 601 52 18 *email: moe-smd@mail.gov.mu* *Fax No: 697 96 99*

Appendix 3- Letter of consent to parent/guardian

LETTER OF CONSENT TO PARENT/GUARDIAN

Date:

Dear Parent/Guardian

My name is **Udhin Waaiza**. I am lecturer at Mauritius Institute of Education. I am presently a PhD student at the University of KwaZulu-Natal – School of Education and Dr D.W.Govender and Dr A. James are my supervisors. One of the criteria for completing my degree is to conduct a research study based on my chosen field of research.

The title of my proposed research is '*Learners' learning through digitized learning resources'.*

The research involves your child participation in an interview process and in observations, which will be videotaped during science lessons. All ethical considerations will be strictly maintained at all time. All information provided will be kept in strict confidence. Please note that participation in this research is voluntary and your child may withdraw from participating at any time he/she feels the need to do so.

----------✂----------✂----------✂----------✂----------✂----------

Declaration

I, parent/guardian of _____ give consent for his/her participation in the research project.

....

PARENT/GUARDIAN DATE

Thank you for your cooperation.

RESEARCHER: Mrs W.Udhin CONTACT NUMBER : CELL :

Appendix 4: Informed Consent Document for teachers participating in the research

Consent form was also given to the teacher concerned for being part of the research. Please see below a copy of the consent form:

Informed Consent Document for teachers participating in the research

Date

CONSENT TO PARTICIPATE IN RESEARCH

The title of my proposed research is ***'Learners' learning through digitized learning resources'.***

You are asked to participate in a research conducted by Mrs W. Udhin, a PhD student at the University of KwaZulu-Natal – School of Education. Contact details for Mrs W Udhin are as follows:

Address : Royal Road, Notre Dame, Long Mountain, Mauritius

Telephone :

Email : w.udhin@mieonline.org

The purpose of the study is of learners' learning through digitized learning resources in Mauritian primary school. Located within a digital era of information technology, school education, worldwide, is being transformed to embrace modes of learning other than just face-to-face contact delivery. The digitized curriculum has lately been introduced in the primary schools of Mauritius. Learners are being now taught via a digitized curriculum. In this context, my research seeks to understand how learners are learning science through this new form of pedagogy. My research will help to get a better understanding of how Grade 4 learners are learning with technology in classrooms. It will also help educational authorities in Mauritius to better design learning for learners.

If you volunteer to participate in this study, you will spend time using the digitized learning resources helping the learners representing their understanding of the concepts through drawings. We will videotape these lessons and interactions with the digital resources so that we can look at them later. You will be asked to keep track of the learners' learning of the concepts through a professional journal. This research will be conducted approximately over a six months period.

Your participation in this research is voluntary – this means that you can decide whether or not you will participate in this study. If you want to stop participating in this research at any time, you can stop. Your decision to stop participating in this research study will not result in any form of discrimination.

All the other information from this research will be kept private and secure. The records will be kept in a locked file cabinet for approximately five years and only people who work on this research will be able to look at them. The records in the journals will be erased after the research has been completed.

This research will not in any way contribute to your results. There will be no cost to you if you participate in this study.There may not be personal benefits from your participation but the knowledge received may be beneficial to the education.

Your anonymity will be maintained during data analysis and presentation of results.If you have any questions about this study, please feel free to contact my main supervisor:

Dr D.W. Govender, University of Kwa-Zulu Natal, Department of Computer Science Education, Tel: 031 2603428, govenderd50@ukzn.ac.za.

----------✂----------✂----------✂----------✂----------✂----------✂----

Declaration

……, (full names of participant), hereby confirm that I understand the contents of this document and the nature of the research project, and I consent to participating in the research project.

I understand that I am at liberty to withdraw from the project at any time, should I so desire.

…… ……

SIGNATURE OF PARTICIPANT **DATE**

Appendix 5: Observation Schedule

Code:

Observation schedule 1 – Learners' learning through digitized curriculum

	Satisfactory	Needs further Help	Remarks
COMMUNICATION			
New constructions of knowledge through brainstorming			
Opportunities for feedback and critical reflection of learners			
Attention of learners			
INTERACTION			
Usage of resource to stimulate attention of learners			
Learners active engagement participation around the resources			
Elicitation of prior knowledge			
Opportunities to interact with interface/resource			
Pupils Attitude			
PLANNING AND CREATING			
Plan actions			
Knowledge of contents			
Knowledge of curriculum			
Knowledge of technology			
Effective use of resource			

Observation Schedule 2: Code:

Name of student:

Cognitive Domain	**Very Poor**	**Poor**	**Fair**	**Good**	**Very Good**
Students understanding of concepts or ideas.					
Students questioning with regard to texts, ideas and knowledge.					
Use of interface to elicit previous knowledge					
Affective Domain	**Very Poor**	**Poor**	**Fair**	**Good**	**Very Good**
Interaction between teacher and students.					
Interaction between students and students					
Deliberate attempts made to increase participation of all students					
Classroom atmosphere					
Group/team work					
Psychomotor Domain	**Very Poor**	**Poor**	**Fair**	**Good**	**Very Good**
Learners' use of visual cues					
Learners' use of audio material					
Learners' performance on interactive interface					

Cognitive Domain

The cognitive domain (Bloom, 1956) involves knowledge and the development of intellectual skills. This includes the recall or recognition of facts, procedural patterns, and concepts that serve in the development of intellectual abilities and skills.

1. Students understanding of concepts or ideas.

Very Poor	Not able to stimulate retrieval of ideas or concept
Poor	Barely able to retrieve basic ideas/concept
Fair	Pupils able to retrieve basic ideas
Good	Ability to demonstrate understanding of ideas or concepts
Very Good	Ability to connect ideas recalled in different contexts

2. Students questioning with regard to texts, ideas and knowledge.

Very Poor	Does not ask question at all
Poor	Ask irrelevant questions
Fair	Ask questions but with basic regards to texts, ideas and knowledge
Good	Students ask relevant questions
Very Good	Demonstrates understanding through questioning on the ideas presented

3. Use of interface to elicit previous knowledge

Very Poor	Students do not remember previous lesson
Poor	Students recall very little of previous lesson
Fair	Students identify some aspects of previous lesson
Good	Students outlines what was covered previously
Very Good	Students interpret previous knowledge through summarising

Affective Domain

The affective domain (Krathwohl, Bloom, Masia, 1973) includes the manner in which we deal with things emotionally, such as feelings, values, appreciation, enthusiasms, motivations, and attitudes.

1. Interaction between teacher and students.

Very poor	No effort observed among the students
Poor	Students are bored or make little effort.
Fair	Students respond through a yes/ No
Good	Students respond in proper sentences
Very Good	Students show willingness to listen and respond to questions

2. Interaction between students and students.

Very poor	No effort to interact observed among the students
Poor	Students are bored or make little effort.
Fair	Students collaborate
Good	Students attends and reacts to discussion among peers
Very Good	Students actively participate in discussion (showing willingness to respond, and satisfaction in responding)

3. Deliberate attempts made to increase participation of all students

Very poor	Instructive class (teacher-centred)
Poor	Students are treated as homogeneous group (lack of inclusivity)
Fair	Pupils are engaged in learning
Good	Pupils' diverse, experiences and abilities are used intentionally to increase participation

Very Good	There is considerable interaction, which are reciprocal and promote shared understanding

4. Classroom atmosphere

Very poor	Lack of social support (behaviour, comments, and actions discourage students)
Poor	Very minimal social support
Fair	Social support is neutral or mildly positive
Good	There is mutual respect and assistance in achievement for the students
Very Good	Teacher supports students by conveying high expectations to put forth their best efforts

5. Group/team work

Very poor	Students are bored and disrupt classes
Poor	Pupils work individually
Fair	Students make little effort to work in team
Good	Pupils are attentive and do the assigned task
Very Good	Students contribute to group activities, and helping peers with much enthusiasm

Psychomotor Domain

The psychomotor domain (Simpson, 1972) includes physical movement, coordination, and use of the motor-skill areas. Development of these skills requires practice and is measured in terms of speed, precision, distance, procedures, or techniques in execution.

1. Learners' use of visual cues

Very poor	Pupils not able to detect visual communication cues
Poor	Pupils face difficulty in grasping the visual cues
Fair	Pupils show little interpretation visual communication cues
Good	Pupils describes the visuals satisfactorily
Very Good	Pupils grasp and interpret concept best through visuals

2. Learners' use of audio material

Very poor	Pupils not able to interpret audio communication cues
Poor	Pupils face difficulty in interpreting audio communication cues
Fair	Pupils interpret little audio communication cues
Good	Pupils interpret the audio material satisfactorily
Very Good	Pupils grasp and interpret concept best through audio materials

3. Learners' performance on interactive interface

Very poor	No interaction with the interface
Poor	Less coordinated performance [learners encounter difficulties to interact with the interface]
Fair	Pupils shows satisfactory manipulative skills
Good	Pupils show confidence in using the interface
Very Good	Pupils are proficient users of the interactive interface (accurate, highly coordinated performance)

Appendix 6- Interview Schedule

Semi- Structured Interview schedule Date: Code: Lesson: Duration: Student Name:	
Research Question 1: what do learners' learn through digitized learning resources?	**Responses**
1. Do you recall what was in the resource?	
2. Did you like what you saw on the screen? Why?	
3. What are you thinking when the teacher called you on the board?	
4. Do you recall what the teacher asked you to do? • Why he asked you to do that?	
5. What happened when you did that?	
Research Question2: How do learners' learn through digitized learning resources?	
1. When you have followed the class, I saw that you were… • Why is this so? • Is it always like that?	
2. Do you talk about the learning through digitized learning resources at home? • If yes, why? • Tell me what you tell your mum/dad?	
3. Do you think your mum and dad learnt the same way? Why?	
4. Did you learn this way last year? • How is it different from previous years?	
5. Describe what you have drawn and why?	
6. Would you be able to act as a teacher and me a student and explain to me what you have learnt today?	
Research Question 3: Why do learners' learn in such ways through digitized learning resources?	
Now, I have some good news for you. We are going to remove the Sankoré projector from your class and we are going to revert back to the whiteboard and marker only. 1. How do you feel about it?	
• Do you prefer working with the traditional board or the interactive board? ○ Why? ○ Give me an example?	

Appendix 7- Sample introductory part for interviews

Sample introductory statement

Good morning children. How are you doing? Am very happy to have you with me today and you are going to help me understand what you learnt in today's lesson. I also want to know more about the beautiful drawings that you have done.

You do not have to worry children. Everything that you will be saying will remain here and nobody will get to know about this information. There is no right or wrong answer, so do not hesitate to voice out everything you feel like regarding the questions asked. Please feel free to share your opinions. (You are also welcomed to follow upon something that your friend has said).

The session will be videotaped. Please do not pay much attention to the devices and please focus on the questions asked. Feel free to ask any additional information at any point in time. I am sure we are going to spend nice moments together and that we will enjoy the sessions.

Appendix 8- Grid for organizing drawings

School:_____ Code:

Name: _____

Lesson:_____

Topic: _____

1	2	3

Appendix 9- Guidelines for Reflective Journal

Date		
Student Code:		
Lesson		
Chronology	**Details of Observation + interviews**	**Reflections**
At the start of the lesson		
During the lesson		
At the end of the lesson		

Appendix 10- Example of an extract of a translation of interview for student Krish

Sandy Government School
Pseudonyme used : Krish (SN K O1), Lesson : Air

	Question	Translation	Answer	Translation
Interviewer	aller, est ce qui to rappelle qui nous ti faire dans sa class la qui ti faire (SB K O1. L1)	1. Tell me what you remember from the class that was just conducted? (SB K O1. L1, T1)		
Interviewee			nous ti faire air	the class was on topic « Air »
Interviewer	Oui	Yes		
Interviewee			avec un entonnoir	With a funnel
Interviewer	Oui	Yes		
Interviewee			on a placé sa dans un bassin	It was placed in a bassin
Interviewer	Oui	Yes		
Interviewee			et pour la bouteille, the bubbles of air ont sortie	And regarding the bottle, bubbles of air came out
Interviewer	Oui	Yes		
Interviewee			pour le entonnoir sa n'a pas	For the funnel, it was not
Interviewer	**sortie, pourquoi?**	Came out, why?		
Interviewee			parce que il y a un trou, l'air passe et sors	Because there is a hole for air to pass in and out
Interviewer	**dans lequel?**	In which one?		
Interviewee			dans l'entonnoir	In the funnel
Interviewer	**c'est pourquoi il n'y a pas de bubbles?**	That's why there is no bubbles		

Appendix 11- Data set used in my study

	Pseudonym	Gender	Age	School	Coding	Observations	Videos	Interviews	Group Interviews	Drawings
1	Trisha	Female	8	SN	SN R	SN T O1,2	SN T V1,2	SN T I1, 2	SN FGI 1	SN T D1,2
2	Kanen	Male	8	SN	SN P	SN K O1,2	SN K V1,2	SN K I1, 2		SN K D1,2
3	Ludy	Female	8	SN	SN L	SN L O1, 2	SN L V1, 2	SN L I1, 2		SN L D1, 2
4	Poovani	Female	7	SN	SN P	SN P O1, 2	SN P V1, 2	SN P I1, 2		SN P D1, 2
5	Krish	Male	8	SN	SN K	SN K O1, 2	SN K V1,2	SN K I1, 2		SN K D1, 2
6	Riyaad	Male	8	SN	SN R	SN R O1	SN R V1,2	SN R I1, 2		SN R D1, 2
1	Pranish	Male	8	VL	VL P	VL P O1,2	VL P V1,2	VL P I1, 2	VL FGI 1	VL P D1,2
2	Raj	Male	7	VL	VL R	VL R O1,2	VL R V1,2	VL R I1, 2		VL R D1,2
3	Mohamed	Male	8	VL	VL M	VL M O1	VL M V1, 2	VL M I1, 2		VL M D1, 2
4	Nishi	Female	7	VL	VL N	VL MO1	VL M V1,2	VL N I1, 2		VL N D1, 2
5	Karen	Female	8	VL	VL K	VL K O1,2	VL K V1,2	VL K I1,2		VL K D1,2
6	Wendy	Female	8	VL	VL W	VL W O1	VL W V1 2	VL W I1, 2		VL W D1,2

Appendix 12: Thematic Analysis

Theme: Critical Reflection during learning	Theme: Learning with different learning styles	Theme: Learning with understanding	Theme: Learning in context
Code: • Miss, air could also be found in the soil for earthworm to breathe. (critical thinking) • Complete silence when the teacher asked about the difference from the use of traditional whiteboard and interactive whiteboard **Sub-theme: Emotional Response to Learning (Enactivism)** Code: • I like what I saw on the screen as in was interesting to learn.	Code: • I used the cursor to move the leaf to the space provided. **Sub-theme: cognitive abilities to recall (Cognitivism)** Code: • I can recall that the teacher explained the concepts "Air" and "Time". • I can remember the images in the resources.	Code: • I have drawn a leaf falling down from a tree. • I drew this to explain that a leaf normally falls quickly because of its light weight • In the morning, the teacher asked me to explain "Air" to the whole class and I could do it. • I cannot explain exactly the same as the teacher does but could explain the main things to my friends. • Friends saying: "Yes, Karen, did that before". • The reason why the teacher asked me to move the object in the space provided is because……(silence) the object falls….. (silence) the leaf falls slowly. • (laugh) I draw a tree and a leaf that is falling down. • My drawing of the leaf does not	Code: • The teacher asked me to draw bubbles coming out from the empty bottle on the IWB. • The teacher asked me to do an exercise and place the leaf in either the section "fall slowly" or "fall quickly". The teacher asked me to move the object in the space provided using the pen. • • During the class, I was very attentive because I had to follow the class. I was following the class while others kept on disturbing. I did not pay attention to what my friends were saying. • I preferred to follow the class attentively. • I am usually a very attentive learner.

• I was happy when my teacher asked to carry out the exercise on the board as I had the chance to participate. Lol. • I talked about the IWB to my parents but they did not understand much and said very good. • I tried to explain to my parents how it works but they could not imagine it well as they do not know much about technology. • They were indeed happy to hear about it even though they did not know it properly. • I do not like if the IWB is going to be removed. So, please do not remove it. I prefer the interactive board from the traditional one, please remove the traditional one.		resemble much the one on the IWB.	• My parents did not learn this way as there was only paper at that time. • We have started using the IWB on this year. • I was following the class attentively because I must follow the class (smiling and laughing). • We should remain silent but those learners there, they are "disobedient". They shout, they move around the class. They are mostly boys and sometimes there are girls as well. • They disturb me when they walk around during the class. • **Sub-theme: Learning through diversity of experiences** Code: • When I was doing the activity on the IWB, it was if I was drawings thigs on games downloaded on my tablet at home.

• I like to learn through the IWB because it is better to understand. • I like the IWB because it shows us how to imagine. I can imagine better and it is more beautiful and shows us images. • The images are lively on the IWB. • I learn better through IWB. • Complete silence…. when was asked about what you were thinking when you were asked to go to the board.			**Sub-theme: Learning through interactions with peers** Code: • I am a very attentive learner and did not pay attention to what other were saying.

Appendix 13: Turnitin Report

Turnitin Originality Report

Learning with Digital Resources by Waaiza Udhin

From Draft Thesis (General)

- Processed on 17-Nov-2019 5:00 PM CAT
- ID: 1215381238
- Word Count: 97149

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